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PROGRESS IN ELECTRIC LIGHTING.

It has long been our custom to publish in September a special number devoted to the electric-lighting situation in its various phases. The early autumn is the appropriate time for special discussion of lighting problems since it marks the beginning of the annual period of greatest activity in the new lighting work. Following this custom, readers of the *Electrical World* may expect to see a very thorough special consideration of many topics related to electric lighting, not as heretofore in a single issue, but enriching all of our issues during September and October. The reason for this abandonment of the earlier policy is not far to seek, for it rests on the very growth of the business. New methods, new apparatus and new interests in electric lighting have so multiplied in number and importance that no single issue of any practicable size can conveniently compass them. The extensions in the uses of electricity and the forms of industry in which electrical energy plays an important part have been singularly great, and the rapid increase in the intelligent scientific study of illumination in all its branches has opened new fields for electric lighting and hence new avenues for the sale of energy.

Instead of publishing a single annual lighting number we purpose to recognize the annual lighting season, during which this journal will be enriched by special articles covering every department of electrical lighting, technical and practical. The papers already secured total nearly two score and range from researches on the technical properties of illuminants to practical discussions of the latest installations for special purposes. We believe that in this way, and in this way only, can we be of the greatest service to our friends in the lighting business. The needs of our readers, from their particular association with the industry, are extremely various and can be satisfied effectively only by a series of articles touching every point of the art; and right here, as an essential feature of further advance, let us point out the necessity of pushing vigorously and aggressively the campaign for good lighting all along the line. Electric lighting for many years rested under the stigma of being a luxury. The time has come when it is, or ought to be, considered as a necessity, and moreover, it is one of the very few necessities of which the prices have actually declined, instead of conspicuously rising, during the past decade. To this end, the recognition of electric lighting as a necessity, the most earnest efforts of all associated with the electrical industry should be directed.

The weakest spot among the infinitude of links that chain the central station to the community is just now the use of electricity in the household. If every dwelling in which a te'ephone can be found had electric lighting and auxiliary

appliances, the business of the central stations would take so sudden an upward leap that it would be hard to follow it. The telephone companies have been most assiduous in driving home to every householder the fact that the telephone is a practical necessity, but the lighting companies have too often given the householder the cold shoulder and a rate which convinces him that electric lighting is still a luxury. Unless the signs of the times fail entirely, however, the more progressive central stations are now building up the household load, not yet to even the small fraction of its true importance, but far beyond the practice of a few years since. Small items are not to be scoffed at in the ledger, if there are plenty of them. The street-railway companies live and move and pay their dividends on nickel contributions. It is clearly the line of advance in electric supply to look sharply after every chance to sell a few kilowatt-hours to someone, or for some purpose, not yet recorded in the books of the company. We give our friends of the lighting fraternity greeting, and we hope that our efforts during the next two months may lay before them material which shall help to their greater activity and prosperity.

TORONTO STREET LIGHTING.

Elsewhere in this issue is described the electric street lighting of Toronto, Canada, which is unique among street-lighting installations on this continent in several respects. It represents a good example of what can be done by placing small lamps at frequent intervals, on one side of the street in some cases and on both sides of the street in others. It also represents about the first attempt on this side of the Atlantic to light all the residence streets of a good-sized city with closely spaced lamps mounted on ornamental poles. The poles and lanterns which they carry are specially interesting because they render the overhead distribution system neat and ornamental. It is by far the largest single installation of concrete poles for electrical purposes yet made, over 24,000 being in use in Toronto. Remarkably good results in concrete molding were obtained with them, so that they present a very smooth and neat appearance. The lanterns, which are supported on the poles by simple and inexpensive brackets, have cylindrical globes of diffusing glass. The concrete poles and lanterns were very carefully designed with a view to neat appearance and low construction cost. Both objects seem to have been attained to a notable degree, and the low cost at which these poles are said to have been produced should stimulate their use elsewhere.

The results in street illumination are, as might be expected, far superior to those usually found in residence streets. The energy expended per mile of street is sufficient, and the results are satisfactory. Other cities should follow the example set in Toronto and work toward the better lighting of residence streets with more sightly construction than has heretofore prevailed. Toronto has demonstrated that there is a happy mean between prohibitively expensive underground construction and common wood-pole construction, and that there are ways of rendering overhead construction neat and artistic.

THE CHEMICAL TECHNOLOGY OF ELECTRICAL ILLUMINANTS.

A very interesting and clearly presented brief on the importance of chemistry in the development of artificial illuminants has recently appeared in *Elektrotechnik und Maschinenbau,* from the pen of Dr. O. Kruh. The writer begins by pointing out that whereas pure yellow-green light represents about 0.015 watt per mean spherical international candle-power, the best arc lamps absorb 0.25 watt and tungsten lamps 1.6 watts per candle-power. He then discusses the chemical relations of the substances employed, both in arc lamps and in incandescent lamps. It is remarkable how few substances have hitherto been found suitable, either in pure or in alloyed form, for illuminating purposes. Moreover, such elements as have been found suitable do not appear to be grouped, or closely related, from a chemical standpoint. Carbon arc lamps are shown to divide themselves naturally into three classes, namely, those that use solid carbons, cored carbons and flaming-arc carbons. The first two classes depend essentially for their light production upon the continuous-spectrum radiation of highly heated carbon in the positive crater. The only purpose served by the core in these cases is the centralization of the arc. In the third class, however, the drop of potential between carbon and vapor is much reduced, while that in the column of vapor is greatly increased. The arc itself therefore yields the principal share of emitted light, and the spectrum is no longer continuous but shows bands or selective distribution. It is to this gas spectrum of bright bands, as distinguished from the continuous spectrum of a glowing solid, that the flaming arc owes its relatively high efficiency. A distinction is clearly drawn between magnetite and flaming carbon arcs, since in the former it is essential that the magnetite should be the negative electrode, whereas in the latter it is a matter of indifference which electrode contains the calcium fluoride. Consequently, in the magnetite arc, as well as in the titanium arc, the phenomena are not merely thermal, but are essentially electrochemical.

Mercury-arc lamps are divided into two classes according to the pressure of the mercury vapor which they contain. In the case of vacuum-tube lamps, the spectrum is essentially of the banded type, or glowing-gas type. In the case of mercury lamps containing mercury vapor under appreciable pressure, as in the quartz-tube lamps, the spectrum is essentially that of the glowing solid type, or continuous type. Nevertheless, up to the present time, a higher efficiency has been reached in the quartz mercury-arc lamps than in the vacuum-tube mercury-arc lamps. Turning to incandescent lamps, the reasons for the blackening of the lamp chamber during the working lifetime receives consideration, among various other subjects. It is commonly supposed that the blackening action is mainly physical, it being attributed to the evaporation of carbon vapor from the surface of the glowing filament and the subsequent condensation of this vapor in the form of a semi-opaque solid film on the cooler interior surface of the lamp chamber. Reasons are pointed out, however, for believing that the action is chemical rather than physical. Thus, if oxygen is present in small quantities within the lamp chamber, it tends to combine with the carbon to form

carbon-dioxide, which, at the higher temperature of the filament, tends to break up into carbon monoxide, with absorption of carbon; while, at the lower temperature of the glass wall, this carbon-monoxide tends to return to dioxide, with release and deposit of carbon. There is thus set up a chemical endless chain taking carbon from the high-temperature filament and throwing it down on the low-temperature glass wall. It is pointed out, in conclusion, that, although the whole known field of chemical substances has already been worked over during recent years, in the search for improved glow-lamp filaments there is yet much hope for future success, in finding either purer specimens of available elementary substances or suitable combinations of more than one element.

UTILIZATION OF PEAT.

A note in the *Digest* gives a report on some instructive experiments tried abroad on peat as a fuel used both directly and as the source of producer gas. Many an effort has been made to utilize peat as a commercial fuel both in this country and abroad, but thus far the economic results have been, in this country certainly, highly unsatisfactory, and most foreign reports show, to say the least, dubious results except in some few instances. However, good peat is not to be despised because of low calorific value. The fundamental trouble with its utilization lies in the usually very large amount of moisture contained, varying from 15 to 20 per cent up to as high as 75 per cent, according to the weather conditions at the time of cutting, the nature of the peat and other circumstances. Once good peat is properly briquetted and dried it makes excellent and economical fuel. The commercial trouble comes from the cost of drying and the uncertainty of the quality of the peat. Peat deposits are usually streaky, large workable veins of uniform quality being comparatively rare. Hence when the peat cutting is done by machinery on a considerable scale the likelihood of very irregular quality is serious, and in any event the cost of drying has usually proved somewhat forbidding. Where labor is cheap hand-cut and sun-dried peat offers much greater opportunities: It is to such fuel that the article particularly refers.

Experiments were also tried with the peat used as fuel under the boilers, and for some time past a large factory has been in operation with peat as a source of power, a portion being burned directly and a portion used in the producer plant just referred to. The fuel consumption varies largely according to the quality of the peat. The variation is nearly 25 per cent above or below the normal according to whether the peat is heavy and rich or the reverse, the poorer peat clinkering from the presence of sand. From the standpoint of economy the results of this combined plant have been rather encouraging, the fuel cost having been reduced by nearly 50 per cent by the use of peat. When of good quality and comparatively dry the peat ran as high as 80 per cent in combustible matter, about 25 per cent being fixed carbon, and the ash was singularly low, only a little over 1 per cent. The case cited represents, it seems to us, one of the instances in which peat fuel can be utilized successfully; that is, with a nearby supply, facilities for sun-drying, and fairly cheap labor. As a general source for power the material still seems difficult of utilization, but the experiments here recorded are sufficient to show that under favorable conditions the economic results are very good. As an indication of the relative value of peat and coal the peat in the instance before us was reckoned at $1.25 per ton and the mixture of coal employed at about $5.60 per ton, so that under the existing conditions the peat equaled in cost good steam coal at about $2.80 per ton—not a bad showing by any means, and quite good enough to encourage similar experiments elsewhere.

THE MUNICIPAL ELECTRICIANS.

At the annual convention of the International Association of Municipal Electricians held in Peoria last month there was observable some tendency to enlarge the scope of the association and to advance it to a higher plane than it has occupied during its sixteen years of existence. About forty-five representatives of the electrical departments of American and Canadian cities were present, and the subjects discussed related to underground cables for fire-alarm and police signaling, the grounding of fire-alarm boxes, ornamental street lighting, electrical inspection, locating and clearing "trouble," and various practical questions relating to fire-alarm and police signaling. The paper on electrical inspection by Mr. W. S. Boyd, of Chicago, was particularly good. In the past the association has not, it must be admitted, made many notable contributions to the art of electrical engineering. And yet it would be a mistake to underrate its accomplishments. Its members are men who are responsible for the proper working of apparatus (considering fire-alarm systems alone) on which rests an enormous responsibility for the protection of life and property.

The association has an opportunity to become even much more useful and to rise to greater development. The electrical departments of American cities have nowadays a much wider view than the supervision of fire-alarm and police signaling, important as that work may be. In street lighting, in the electrical operation of such municipal utilities as water-works pumping stations, in the enforcement of proper rules for the installation of wires and electrical apparatus, in the study of such questions as electrolysis, rates for electric service, telephone and street-railway operation, the modern city electrician should be a man competent to give his municipality honest technical advice. The old order is changing. The fire-alarm office is broadening into something bigger and more important, and signs of this change are evident in the small cities as well as the large ones. The International Association of Municipal Electricians must adapt itself to this change if it is to occupy the field widening before it. It can do great things in uplifting the standard of work done by city electrical departments, and there are indications that it is awakening to the importance and magnitude of the task before it. Nearly all the societies in the electrical field have had to undergo a rehabilitation period, and it looks as if that of the municipal electricians were near at hand.

INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

The eighth annual congress of Applied Chemistry held its inaugural meeting on Sept. 4 at Washington, D. C., with several hundred delegates in attendance from many countries of the world. On the afternoon of the first day the delegates were received by President Taft. On Sept. 5, the second day, there were visits to the art galleries, the Library of Congress and the government laboratories. Special trains took the members to New York City late in the afternoon. The congress continued its work in section meetings held at Columbia University. As announced previously, the American Electrochemical Society will meet jointly with the congress, commencing Sept. 7.

NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION.

For the purpose of creating more electrical business throughout the New England States there has been formed in Boston and chartered by the Massachusetts Legislature an organization called the Electrical Development Association. The association is composed of central-station men, manufacturers, jobbers and contractors. It is proposed to have an information bureau which will give to contractors full information on all new electrical devices and apparatus which may be placed on the market and which investigation may show are indorsed generally by the public. It is proposed to cement as far as possible the relations between contractors and central stations so that, contractors being active to the fullest extent in securing new business for central stations, the latter will respond by helping the contractors to make direct sales of appliances to consumers as well as to wire new customers' premises. The president of the association is Mr. Frank S. Price, Pettingell-Andrews Company, Boston, and the secretary is Mr. Zenas W. Carter, 53 State Street, Boston.

CONGRESS FOR TESTING MATERIALS.

At the opening of the sixth congress of the International Association for Testing Materials on Sept. 3 in the Engineering Societies Building, New York, there were present about 400 members, representing twenty-seven countries. Captain Robert W. Hunt, president of the American Society for Testing Materials, in welcoming the members in the name of that organization, announced that the meetings would be in charge of Dr. Henry M. Howe, who has acted as president since the death of President Charles B. Dudley.

Dr. Howe stated that the membership now totals 3700. In closing, he pointed out that "in building a society fitted for the immediate end of improving methods of testing, we have simultaneously fitted it for the indispensable supplement, specification making, particularly international specification making. In bringing together those competent to improve methods of test we have also brought together those most competent to draw specifications. We have unconsciously made an organization fitted for filling both needs of the public, for telling it both what properties, quantitatively, its purchases need and also how to measure those properties."

The professional work of the congress was carried on in three separate sections. Section A was devoted to metals, Section B to cement, stone and concrete, and Section C to wood, oil, bitumen, rubber and other materials. The proceedings were conducted in English, German and French, all important statements in one language being translated immediately into the others by officials of the several sections.

PENNSYLVANIA ELECTRIC ASSOCIATION CONVENTION.

(*By Telegraph.*)

With a registered attendance of over 250 the fifth annual convention of the Pennsylvania Electric Association, state branch of the National Electric Light Association, opened at the Bedford Springs Hotel, Bedford Springs, Pa., on Sept. 4. The hotel is situated among the eastern ridges of the Allegheny Mountains, at an elevation of about 1200 ft., in the township of Bedford, Bedford County. The place is about 45 miles from Altoona, where connection is made with the main line of the Pennsylvania Railroad, and is noted for its mineral springs. These possess medicinal properties said to rival those of the springs at Carlsbad, Austria. The estate covers about 4000 acres and includes golf courses, tennis court, bowling alleys, swimming pool and other means of diversion, all of which were pressed into service during the week of the convention by the entertainment committee.

A reception to President R. S. Orr, which was held on Tuesday night in the ballroom of the hotel and was followed by a dance, marked the beginning of the social festivities for which the conventions of the Pennsylvania Electric Association are noted, and lest time should hang heavy on the hands of any of the men present, a Browning society was formed, and almost everyone took advantage of the opportunity to join.

The regular meetings took place in the large ballroom of the hotel and were well attended. A few of the Class D members of the N. E. L. A. made an exhibit of apparatus, etc., in the room to the rear of the convention hall and also on the piazza adjoining, but no heavy apparatus was on display. The papers were distributed to the delegates in the registration bureau to the left of the lobby, where were also displayed all of the prizes donated by Class D members, ranging from loving cups, radiant heaters and fans to pocket flash-lamps.

In his address President R. S. Orr likened the convention of the association to a clearing house through which the experience, training and judgment of many men are made available to all. This exchange, he said, is effected through the reading of papers specially prepared, through the discussions which follow and through the opportunities afforded of bringing all the members into personal contact.

He spoke of the difficulties which confronted the association in getting the men from the smaller companies to take part in the deliberations, owing to the fact that these men can spare neither the time nor the expense incident to the work, and suggested that the association meet the expenses of individual members engaged in collecting data, etc. The president also recommended that a special committee be appointed for the purpose of taking up with the telephone, telegraph and railroad companies of the State the matter of adopting a uniform method of securing exchanges of pole privileges and rights-of-way.

This committee, in the judgment of the president, could also deal with questions relating to the joint occupation of poles and also with wire crossings, since many of the questions with which such a committee would have to deal would be materially affected by local peculiarities of state and municipal laws and customs and their definite determination in detail can best be effected by the geographical sections. Mr. Orr also called attention to important legislation which will doubtless come up for consideration during the year, intimating that a public-service commission would be appointed, and emphasized the desirability of the association watching such legislation. At the conclusion of the address a motion was made to refer the report to a committee for consideration and the preparation of recommendations to the convention before adjournment.

Reports were read by the program committee, entertainment committee, executive committee, treasurer and mem-

bership committee. The latter showed that there are now in the association eighty-five Class A members, 1025 Class B members, twenty-eight associate members and one honorary member, or a total of 1131, as compared with 949 in 1911.

After calling attention to the fact that this is the thirtieth anniversary of the electric-light industry, Mr. A. R. Granger offered a resolution directing that a congratulatory telegram be sent to Thomas A. Edison, the founder of the industry. The resolution was received with applause.

The lamp committee in its report drew attention to improvements and developments in the art of incandescent-lamp manufacture, the most important of which were the wire-filament tungsten as distinguished from the pressed filament and the introduction into the lamp of certain chemicals to improve its candle-power. At present the chemical is placed on the stem of the 100-130-volt, 150, 250, 400 and 500-watt lamps only and results in a lamp with a specific consumption of 1 watt per candle and in an approximate life of 1000 hours. The same chemical has also been introduced into the series street lamps of 100, 200 and 300-cp sizes. The chemical is said to neutralize the action of harmful gases, thereby preventing premature blackening and maintaining a longer useful life. In the series street lamps a single size of drawn wire is now employed, the length being varied to suit the wattage desired. The committee recommended that in the future all tungsten series lamps be given standard current ratings of 3.5 amp, 4 amp, 5.5 amp, 6.6 amp and 7.5 amp. The filament has resulted in better efficiency in the larger lamps, although the smaller lamps require more current, owing to the heat radiation of the leading-in wires. Considerable trouble was found by a number of companies with the 5-watt tungsten sign lamps, but the committee reported that improvements made in the product would eliminate these troubles hereafter. It also reported a 1-watt multiple sign lamp for 100-130-volt circuits to replace carbon-filament lamps without rewiring. Tantalum-filament and carbon-filament lamps are now made only on order and the graphitized-filament lamp now occupies the field formerly held by the carbon-filament lamp. Changes in base terminology, such as the substitution of the word "screw" for "Edison" and "bayonet" for "Ediswan," together with others, were reported. From the information given to the committee by member companies it is evident that there is a marked growth in the number of street series tungsten lamps in use, although some users do not get satisfactory performances from the lamps.

In the discussion which followed the reading of the report by the chairman of the committee, Mr. C. W. Ward, Pittsburgh, it became evident that many companies experienced trouble with the series tungsten lamps, and the opinion expressed was that unless something is done to improve the product the series tungsten lamps for street-lighting purposes will experience a setback. Those taking part in the discussion were Messrs. G. F. Wendle, Williamsport; H. N. Muller, Pittsburgh; A. R. Grander, Chester; C. W. Ward, Pittsburgh; T. Sproule, Philadelphia; S. C. Pohe, Bloomsburg, and C. W. Bettcher, Harrison, N. J. Mr. Robertson called attention to the fact that the Underwriters limit the amount of power of a single lamp circuit to 660 watts and that at the present rating of lamps no circuits are loaded. He suggested that in addition to the various lamps at present on the market lamps rated at 110, 220, 330 and 660 watts be made available.

He stated that the chemical inserted in the lamp might give a yellow discoloration on the end of the bulb, but that the candle-power notwithstanding is improved over that of a lamp not so treated because the chemical combines with the black given off by the tungsten filament and forms a transparent coating on the bulb. Mr. Granger also called attention to the short life noted on tungsten series lamps when operated on circuit with 4-amp magnetite-arc lamps.

The report of the overhead-line construction committee was made up of three parts, the first part treating of the inspection of electric service companies' pole lines, the second part being a practical story of low-tension distribution, showing how it was done, what it cost and what it did, and the third part discussing recent developments in transformer hanging. The chairman of the committee, Mr. P. N. Muller, said that the inspection of electric light and power lines and overhead equipment in general has not received the attention accorded the other parts of central-station systems, inasmuch as miles of line have been operated without any attention whatever further than to replace defective poles and cross-arms caused by general deterioration and which were only found after failure of the part. The committee is of the opinion that reasonable inspection and maintenance will give the central-station operator better standing in the courts and tend to offset the antagonistic attitude of the public, which makes itself felt in the voltage limitations prescribed in ordinances and in agitation for underground construction. Accordingly the committee recommended a systematic inspection and records of the same and outlined a method for the benefit of the member companies. The belief was that the operating executive officials responsible for the construction would take advantage of the information thus afforded not only as a defensive measure but also and chiefly for economic reasons. The character of inspection warranted depends largely on the class of maintenance desired, which in turn is dependent upon the importance of the service a certain line is delivering. The inspection and record recommended cover the following: (1) Improper setting of poles as to location, depth and alignment; (2) failure of foundations by landslides, washouts, etc.; (3) insufficient dimension for burden or side stress; (4) weakening by decay at and below the ground line; (5) weakening by decay at the heart; (6) weakening by decay or other causes above the ground.

The committee called attention to the use of a monocular for inspection of lines and outlined a method of overhead inspection covering sag of wire, insulation of wires, unsafe clearances between wires of various kinds, interference from trees, buildings and foreign wires, loose or improper tie wires, bad or improper insulators, broken or falling pins and broken or failing cross-arms. The question of frequency of inspection must, of course, be determined locally. The recent developments in transformer hanging treated by the committee had to do with installations possessing maximum strength with minimum material where the results sought are high factors of safety electrically and mechanically, expeditious replacement of parts, minimum cost of material in securing greatest mechanical strength, and improvement in appearance of construction.

The report was discussed by Messrs. T. Sproule, Philadelphia; P. N. Muller, Pittsburgh; E. F. McCabe, Titusville; R. S. Orr, Pittsburgh; J. S. Francis, Philadelphia; G. W. Wendle, Williamsport; J. P. McDonald, Philadelphia; E. P. Davis, Williamsport; Van Dusen Rickert, Pottsville; L. H. Conklin, Warren; and W. W. McCleary, Pittsburgh. It was apparent from the discussion that a necessity for close co-operation between the railroads, telephone companies and electric light companies exists, and that, while all recognize that reasonably good and safe construction is the thing required, the difficulty lies in effecting quick connections owing to the system at present followed in getting permission from railroad and telephone companies to cross rights-of-way or to use poles.

Mr. McDonald suggested that the Pennsylvania Electric Association start a movement to get together the various companies interested for a discussion of the matter. The session adjourned with the appointment of the nominating committee, consisting of Messrs. C. J. Russell, Philadelphia; L. H. Conklin, Warren; and G. F. Wendle, Williamsport.

STREET LIGHTING WITH QUARTZ-TUBE MERCURY-VAPOR LAMPS.

Six 770-watt quartz-tube mercury-vapor lamps, with a specific consumption of 0.4 watt per cp, have been experimentally installed to light the Randolph Street block between Lasalle Street and Fifth Avenue, Chicago, the first street in America to be so equipped. This novel departure in street illumination, utilizing the most efficient electrical illuminant known, was installed by the Randolph Street Improvement Association and converts an otherwise rather dark street, almost devoid of electric signs and night displays, into an inviting thoroughfare flooded with illumination said to have an intensity equal to eight times that of full moonlight. The uniform distribution on the street surface and the distinctness with which persons, objects, signs, traffic vehicles, etc., all appear under this lighting attract the notice of passers-by. Of equal interest to the adjoining property owners who contribute to the maintenance of this installation is the low energy consumption and cost of operation of the quartz-tube units.

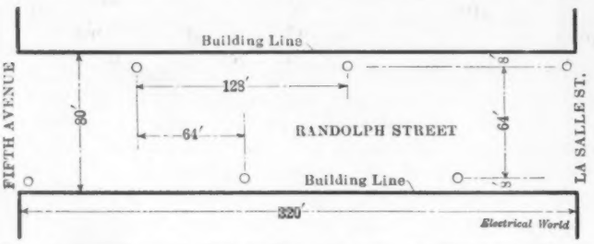


Fig. 1—Location of Quartz-Tube Lamps on Randolph Street, Chicago.

The six lamps are suspended from boom hangers at a distance of 8 ft. from the buildings and 40 ft. above the sidewalk. In the 320-ft. block the six units are ranged three on each side of the street, the opposite rows being staggered, thus making the distance between lamps on the same side of the street 128 ft., or one lamp for each 64 ft. of street. As the width between building lines is 80 ft. and each lamp clears the buildings by 8 ft., the distance between the two rows of lamps is 64 ft., thus placing a lamp at two diagonal corners of each 64-ft. square. While no photometer measurements have been taken, the average intensity on the street surface for the whole block is estimated at more than 1.67 ft.-candles.

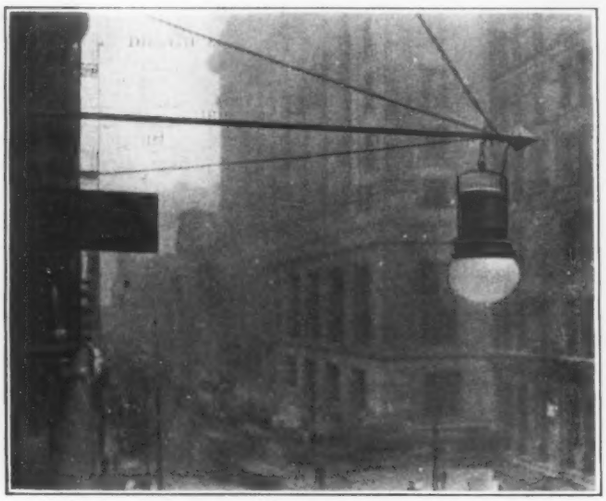


Fig. 2—Quartz-Tube Lamp on Hanger 40 ft. Above Street.

In color the light from these lamps approaches white, only a suggestion of the familiar mercury-flame color remaining. When worked at the higher temperatures possible with quartz tubes, the slight red line in the ordinary mercury-vapor spectrum is expanded and augmented, making the resultant light more nearly white and producing the extremely high efficiency already noted. The lamps used on Randolph Street are of the 770-watt, 220-volt "Z" type manufactured in this country by the Cooper Hewitt Electric Company. Their mean candle-power in the lower hemisphere, with clear-glass globes and reflectors, is stated to average 2500, while a maximum value of 4900 cp has been measured in parts of the distribution curve. The minimum light intensity within the effective angle of 57 deg. with the vertical, however, is 3200 cp, which more nearly indicates

Fig. 3—Night View of Randolph Street, Lighted by Quartz-Tube Lamps.

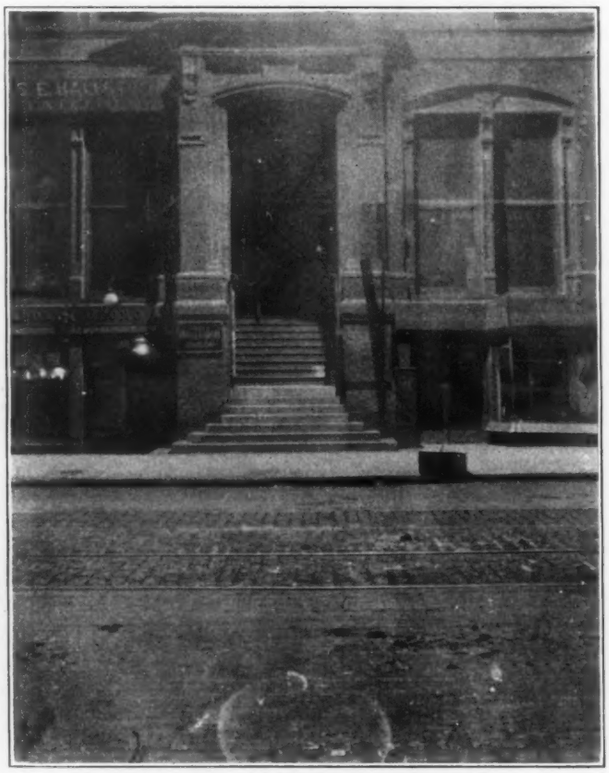


Fig. 4—Illumination on Street and Building Beneath Lamp.

the useful candle-power of the lamp, considered from the standpoint of street illumination.

Erected in place and ready for operation, the cost of installing the system was within $100 per lamp. All the units are operated from dusk until midnight or 1 a. m., after which the two lamps nearest the center of the block are in service until dawn. For the operation of this quartz-tube lighting installation, including energy, maintenance, etc., the cost is estimated at $444 per year, which is at the rate of about $0.69 per curb-ft. per year.

Mr. Karl Eitel, president of the Randolph Street Improvement Association, has expressed himself as thoroughly pleased with the lighting from the standpoints of attracting traffic and increasing public safety, and also as a good business investment. He has interested the Association of Commerce in the plan, hoping to see this lighting extended to other "Loop" streets which, except for corner arc lamps, are now plunged in darkness after nightfall. The arrangement of the lamps was planned by Mr. George C. Keech, of the Cooper Hewitt Electric Company. Mr. F. W. Hoyt is secretary of the improvement association.

THE TUNGSTEN LAMP SITUATION.

As our readers will remember, the report of the lamp committee of the N. E. L. A., presented at the Seattle convention during June last, showed very clearly that of the total number of incandescent lamps sold annually in this country the percentage of tungsten-filament lamps is increasing rapidly. At the same time the percentage of carbon-filament lamps is diminishing steadily, while the proportion of metallized-filament lamps is increasing at a moderate rate. Aside from the fact that the carbon-filament lamp is the least efficient of all, there is in the commercial aspect of the situation another factor ascribable to the expiration of patents on the carbon lamp, thus making it impossible to restrict the use or fix the re-sale price of these lamps, while, of course, our existing patent laws permit both of these practices with respect to metallized-filament and tungsten-filament lamps. Considering that both the metallized-filament and tungsten types of lamp are covered by patents, it is evident, in view of the inferior economy of the former type, that the market for it is maintained largely on a basis of the difference in price.

Much interest over the tungsten lamp situation centers in the infringement suit recently filed by the General Electric Company against the Laco-Philips Company, of New York, in which the complainant cited the well-known Just and Hanaman patent, No. 1,018,502, isssued Feb. 27, 1912, which it holds by assignment. Action was brought in the United States District Court for the Southern District of New York, and the plaintiff alleged injury of its lamp business through infringement by the defendants, and prayed for an injunction and a decree compelling the payment of the defendant's profits to the court with such assessment as the law provides for. No answer has yet been filed to this action by the Laco-Philips Company, and it is said that possibly none will be made until next month.

The Just and Hanaman patent describes a number of methods for the manufacture of filaments containing tungsten. By one method a mixture of tungsten and organic binding media is carbonized, and thereupon the carbon is removed by chemical means, the remaining filament or body consisting purely of tungsten. The specification also states that compounds of tungsten may be utilized in the same manner. Again, finely divided tungsten, or some tungsten compound which is readily reduced by carbon to a metal, such as tungsten oxid or tungsten acid, is mixed with an organic binding medium, such as a solution of cellulose in chloride of zinc, collodion or coal tar, the filaments then being formed by pressure and carbonized. Efficient filaments may be obtained, the inventors state, by adding 2 to 10 grams of tungstic acid to a solution of 10 grams of cellulose in 260 grams of chloride of zinc of the specific gravity of 1.83, this mixture then being formed into filaments and carbonized in the presence of air. The stage at which the filaments consist of a carbon tungsten mixture is purely intermediate.

The carbon may be removed by raising the filament to a high temperature, by means of an electric current, in an atmosphere of steam and hydrogen, in which the carbon is completely oxidized into carbonic oxide. Such filaments may be equalized in a manner analogous to that employed in the treatment of ordinary filaments, by submitting them to the heating action of an electric current in an atmosphere of volatile tungsten compounds with a considerable quantity of hydrogen present, so that the deposited tungsten will produce the desired equalization. The coating process is also described, wherein carbon filaments are coated with tungsten by heating electrically in the presence of a vapor mixture composed of hydrogen and a halogen compound of tungsten. After a sufficiently thick layer of tungsten has been deposited, the heat treatment is continued in an atmosphere of neutral gases, and in a short time the carbon contained in the core is absorbed by the metal surrounding it, producing a perfectly homogeneous filament. The next operation is to remove the carbon by the methods already described.

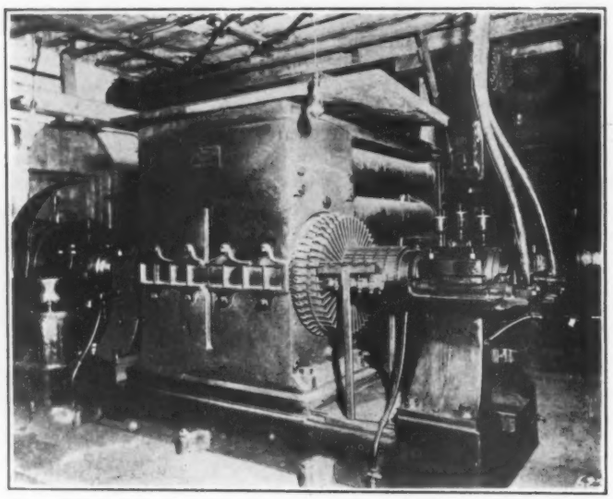
The inventors describe their filament as consisting of dense coherent tungsten metal, having a high fusing point of approximately 3200 deg. C., and capable of incandescent efficiency at a rate of less than 1 watt per cp, being substantially free from perceptible disintegration at that efficiency. The patent contains only three claims, the first of which is: "A filament for incandescent lights consisting of tungsten in a coherent metallic state and homogeneous throughout." Claim 2, which is nearly as broad, is as follows: "A filament for incandescent lights consisting throughout of substantially pure metallic tungsten of high fusing point and electrically conductive, the light-emitting properties of the filament being due to the coherent, homogeneous metallic nature of the tungsten."

As is well known, the Laco-Philips Company is not a domestic manufacturer of tungsten lamps, but is importing lamps made at Eindhoven, Holland, by the Philips Metallic Glow Lamp Works. While the defendant has not as yet filed a formal answer to the suit, it has announced the substance of its position in the matter, which is, first, that the Just and Hanaman patent is invalid and, second, that the drawn-wire tungsten-filament lamp which it is selling would not infringe the patent even if it were valid.

It appears on the face of the matter that this action marks the opening of litigation over the tungsten-filament lamp as important and as long-drawn-out as the well-known litigation which was carried on over the carbon-filament lamp for more than seven years. Considering the fact that the imported lamp marketed by the Laco-Philips Company is not patented, it seems fairly evident that this action by the General Electric Company was taken to protect its lamp licensees, who are paying royalties for the privilege of manufacturing tungsten-filament lamps under this patent. Conflicting rumors are current as to the true nature of the situation, it being held in some quarters that the suit is brought in good faith against one of the strongest of a number of alleged infringers, in order that the possible victory in this case will make it unnecessary to proceed formally against the others. On the other hand, it is regarded by some as possible that, since the Philips company in England avoided litigation with the General Electric interests and secured a license, the outcome of the present suit will be similar, amounting in short to a prearranged program for strengthening the patent commercially. Future proceedings in the whole matter will be awaited with much interest.

ELECTRIC LIGHTING DEVELOPMENT IN NEW YORK.

Many of our readers are familiar with the facts concerning the introduction of electric lighting in New York City. These facts were set forth briefly in our thirtieth anniversary number published on March 5, 1904. On Wednesday, Sept. 4, 1911, occurred the thirtieth anniversary of the beginning of commercial incandescent lighting, the



Electric Generator Used in the First Central Station in the World.

famous Pearl Street station in New York having been placed in service in 1882 by Mr. Thomas A. Edison. In December, 1880, there was organized what was known as the Edison Electric Illuminating Company as the licensee of the Edison Electric Light Company, which held Edison's electric light patents. After two years of preliminary work, there was established a steam generating station, a distribution system of some 15 miles and about 400 incandescent lamps. Thirty years of commercial growth has seen this system become one of 1300 miles of cable, 360 of which are of the high-tension transmission system, while the number of incandescent lamps has become about 5,250,000, the connected load equaling 714,000 hp.

The early generating equipment consisted of six 125-hp steam-engine-driven units of the now historical "Jumbo" type, similar to those that had been constructed in Edison's Goerck Street manufacturing plant and shipped to London and Paris. During the summer of 1882 the underground distribution system was planned and laid out and the wiring was installed in the buildings of prospective customers. The wiring of these buildings, the laying of the street mains and the installation of the generating apparatus were done under the personal supervision of Mr. Edison.

The six Jumbo generators in the Pearl Street plant continued in operation until Jan. 2, 1890, when fire destroyed the building. Only one generator was saved, and that only because it was near a window and firemen playing their hose from the elevated structure were able to confine the flames to the rear of the floor. That fire put the lighting system out of commission for less than half a day, because the Liberty Street annex opened in 1887 was able to take up the load. By placing certain restrictions on the use of energy, it carried the burden until new machinery was installed at Pearl Street. In 1890 another annex to the Pearl Street station was opened in the Produce Exchange Building. In the meantime the new Duane-Pearl Street station, the fourth that had been built to meet the increasing demands for electric light, had been completed, and in 1895 the old station, outgrown and out of date, was dismantled and sold. The remaining Jumbo generator yielded to machines of greater power and more modern design, and it is now treasured by the New York Edison Company as a relic of the early days of the lighting industry.

With the exception of this and one other interruption, aggregating together less than twelve hours, electric lighting service has been continuous in New York since the day the first generator was started—a remarkable fulfilment of the inventor's prophecy that the service would go on forever unless stopped by an earthquake.

The original Edison plan called for the generation of energy at as many as thirty-six independent stations south of Fifty-ninth Street, each with its own steam-boiler equipment. However, through the use of the high-tension system of transmission which began on Nov. 3, 1898, it became possible to concentrate all the generating apparatus at one locality and to operate at various parts of the city, not the steam generating plants that had first been planned, but substations connected with the central station by high-tension feeders.

The Waterside stations of the New York Edison Company, built in 1900 and 1905, are the result of the concentration made possible by the system of high-tension alternating-current transmission. These generating stations occupy two city blocks on the East River front and have an equipment rating of approximately 700,000 hp. Through some 1300 miles of cable, which connect the thirty-one substations with the generating stations and interconnect the substations each with the other, energy is now supplied in New York to 5,245,000 incandescent lamps, 40,400 arc lamps and 337,000 hp in motors, while 159,000 meters are required to measure the energy. The Edison system covers practically the entire island of Manhattan, with its 22 square miles, and the borough of the Bronx, which contains more than 45 square miles.

Although the Edison Electric Illuminating Company was the first organized company to do commercial electric lighting and the Pearl Street plant was the first central station in the world, there were earlier instances of incandescent lighting, all based on the inventions of Mr. Edison. In fact, at his own home in Menlo Park he had laid out an underground system supplying energy to more than 400 lamps, and in 1879 a lighting system had been installed on the steamship *Columbia*, while less than a month prior to the opening of the Pearl Street station a small generator of a different type had been placed in operation at Appleton, Wis., where a waterfall supplied the power.

BIG CREEK HYDROELECTRIC DEVELOPMENT.

The Big Creek Development in central California, reached after a climb of over 50 miles into the mountains on a railroad just built by the Stone & Webster Construction Company, the contractor for the entire work, is not only one of the largest but in several respects is the most interesting undertaking in the country. In addition to involving the highest voltage for transmission over the longest distance yet attempted, the installation possesses many features of interest from the purely hydraulic standpoint.

If a straight line be drawn, extending from San Francisco to Los Angeles, and from a point on this line slightly over a third of the way down another line be carried at right angles 100 miles eastward into the heart of the State, its further end would mark the site of the Big Creek operations. The point is 175 miles from San Francisco and 275 miles from Los Angeles, and the elevation is about 7000 ft. In the total installation a fall of 4000 ft. will be utilized to generate 120,000 kw for the system of the Pacific Light & Power Corporation, which already has an aggregate equipment rating of 70,000 kva in six hydroelectric and three steam plants.

The Pacific Light & Power Corporation serves a popula-

tion of 400,000 in Los Angeles and surrounding towns, including Pasadena, San Bernardino and Riverside. Its operating records for 1911 indicate that the expenses of production and maintenance per unit of output by the steam plants are over five times those of the water-power plants. The cost of transmitting energy from the latter is naturally greater per unit, but the records show that the

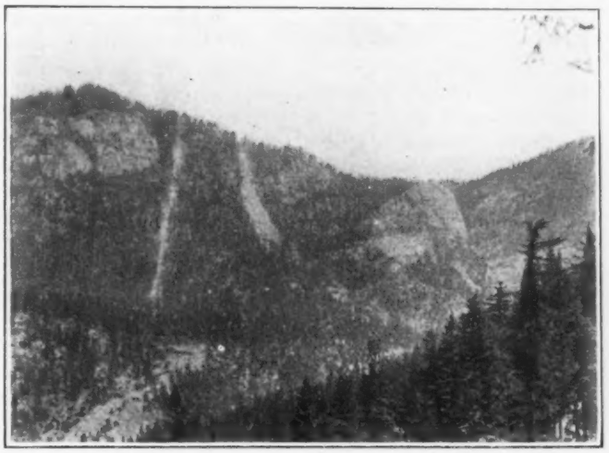


Fig. 1—View Showing Incline and Pipe Lines for No. 1 Development.

entire expense of the water-power developments is less than a third of the cost of energy delivered from the steam plants. It is in order to save this difference in operating expenses that the corporation is now constructing the hydroelectric development at Big Creek.

Before the completion of the construction railroad it was practically impossible to proceed with the main power development on account of the great difficulty and expense of getting in material and supplies. The road branches off from the Southern Pacific at a point 22 miles north of Fresno. Work was begun on Jan. 26, 1912, and on July 10 the last spike was driven, probably a record for a railroad built through such rough country.

For over 25 miles the road runs on a private right-of-way to the Sierra National Forest Reserve, where the trains begin their heavy climb through the mountains. The maximum grade is 5 per cent and the maximum curvature 60 deg.

At the site of power house No. 1, 2100 ft. below the storage reservoir, large railroad yards have been installed, connecting with a standard-gage inclined hoist which extends over 2 miles to the reservoir. Here 7 miles of track join the storehouses, camps and dam sites, making it possible to carry material by rail to any part of the work.

It is estimated that over 50,000 tons of material will be used for the initial equipment and 100,000 tons for the total installation. At present 1500 men are employed, and two permanent camps, built to care for approximately 1000 men each, have been established. The construction company maintains boarding houses, stores and a well-equipped hospital with a resident surgeon and nurses, where sick and injured employees can be cared for.

Big Creek, with its tributaries, rises in the Sierras and drains an area of about 80 sq. miles. Just above Big Creek Falls the stream flows through a mountain meadow, which is now being converted into a reservoir with a storage capacity of approximately 100,000 acre-ft. The mountains which mark the northern and eastern boundaries of the basin rise to elevations of 10,000 ft. and 11,000 ft., with only a small section below 9000 ft. The southern and western divides are comparatively low, however, and offer little obstruction to the warm, moisture-laden winds from the Pacific, which cannot cross the peaks to the north and east without a large precipitation. The annual rainfall on the Big Creek watershed is more than 80 in. for an average year, and the run-off is equivalent to at least 50 in.

Three gravity-section, concrete dams, two 100 ft. and the third 164 ft. in height, will close all the natural openings in the basin. These dams will be built upon solid granite formation, the construction material with the exception of the cement being available close at hand.

Upon leaving the basin, Big Creek drops about 4000 ft. within a distance of 6 miles. With such a great difference in elevation, and with a reservoir to equalize the flow of the stream, a comparatively small amount of water is necessary for hydroelectric development. If there were no inflow for five months, it would probably be possible to operate during that period on storage alone, assuming a 50 per cent load-factor.

From the reservoir the water will be led southwest through a 4000-ft. tunnel cut in solid granite to a steel flow pipe, which will continue 6800 ft., along the surface to the mountainside above Big Creek. Here the water will enter pressure pipes and drop about 2100 ft. through the wheels of power house No. 1 to the forebay of a second tunnel, to be formed by a dam, 70 ft. in height, built across the bed of the creek. Tunnel No. 2 will carry the water through solid granite to the crest of the gorge, about 4 miles southwest of power house No. 1. From the outlet of this tunnel the water will enter pressure pipes and fall about 1900 ft. to power house No. 2.

It will be possible to generate about the same power at each of the plants, as the forebay of the second tunnel will be located at a point just below the juncture of Pitman and Big Creeks, and the additional supply of water will increase the power available at station No. 2 and in a

Fig. 2—Site of Dam No. 4.

measure compensate for the difference in static heads at the two plants.

The power houses will be built of reinforced concrete, and each will have an ultimate equipment of 60,000 kw in four wheels, of which two will be installed initially. Either plant will be capable of operating without the other, if desired, as power house No. 1 can be "by-passed."

The generating units will consist of three-phase, 6600-volt alternators driven by two overhung impulse wheels mounted on the same shaft. The combined rating of the two wheels of each unit will be 20,000 hp. The emf from the generators will be stepped up to 150,000 volts, a new record for transmission emf.

The transmission lines will be longer than any operating lines yet installed, the length being 275 miles. They will consist of a double set of steel towers, each supporting three steel-cored aluminum conductors arranged in horizontal plane. The lines will be located on a private right-of-way for a large part of the distance. At Los Angeles a substation equipped with synchronous condensers and step-down transformers will convert the voltage to a value suitable for delivering energy over the existing distributing systems.

MUNICIPAL ELECTRICIANS IN SESSION AT PEORIA.

With a registered attendance of about 110, the seventeenth annual convention of the International Association of Municipal Electricians was held at Peoria, Ill., on Aug. 27 to 29. President John W. Kelly, Jr., chief of the Electrical Bureau of Camden, N. J., occupied the chair, and Secretary Clarence R. George, city electrician of Houston, Tex., performed the duties of his office. Mr. W. E. Wolgamott, city electrician of Peoria, was chairman of the executive committee and made the local arrangements. The sessions were held in the assembly room of the new Jefferson Hotel, and here also were displayed exhibits by a number of manufacturers. Mayor Woodruff of Peoria welcomed the delegates and Mr. Clark E. Diehl, of Harrisburg, Pa., responded.

In his presidential address Mr. Kelly urged that the powers of municipal electrical inspectors be enlarged to take in all electrical matters in the city. The chief of the electrical bureau in a large city is much more than a signal engineer; he has problems to solve in all branches of electrical engineering.

Papers were read as follows: "Underground Cables for Fire and Police Telegraph Service," by Mr. E. G. Loomis, Pittsburgh; "Grounding Street Boxes," by Mr. T. C. O'Hearn, Cambridge, Mass.; "Ornamental Street Lighting," by Mr. A. M. Klingman, Cleveland; "Electrical Inspection from the Underwriter's Viewpoint," by Mr. W. S. Boyd, Chicago; "Municipal Inspection," by Mr. Charles H. Lum, New York; "Testing and Inspecting Fire Boxes," by Mr. W. L. Riehl, Cincinnati; "Handling Fire Alarms," by Mr. John Berry, Indianapolis; "Police Call or Flashlight System," by Mr. W. E. Wolgamott, Peoria; "Locating Trouble on Lines and Cables," by Mr. Leo Firman, Philadelphia.

ORNAMENTAL STREET LIGHTING.

Mr. Klingman, in his paper, stated that there are now about 400 ornamental street-lighting systems in the United States, whereas in April, 1909, there were only six. He made a plea for sufficiently high suspension of high-candle-power sources. Intensity on business streets should be from 0.4 to 0.5 ft.-candle. Single-line, rather than staggered, lighting should be used on the curving driveways in parks.

POLICE-CALL SYSTEM.

The police flashlight system of Peoria was described by Mr. Wolgamott. To convey signals to policemen while patrolling, eighty lamps are used at night and the same number of bells in the daytime. The bells and lamps are placed at street intersections, either on tops of posts supporting fire-alarm boxes or on brackets extending from arc-lamp posts. When a policeman hears or sees a signal he telephones police headquarters at once. The system is used not only to get into communication with policemen on beat but also as a check to show that they are traveling their rounds. At each location there is a weatherproof box containing a polarized relay by means of which the bell can be rung or the lamp lighted, as desired. The small amount of energy needed is supplied to the city without charge by the Peoria Gas & Electric Company. The system is very useful in police work, in tracing criminals or in cases of riot.

MUNICIPAL INSPECTION.

Mr. Boyd, although connected with the Underwriters, advocated municipal regulation for electrical inspection to protect lives and property. This inspection is a natural municipal function; the supervision must extend to non-insurers as well as to insurers. Furthermore, the regulation should cover outside as well as inside wiring. Final decision as to inspection should not be left with owners or tenants. The present problem of electrical inspection relates to the small cities. Mr. Boyd advocated the creation of state departments for electrical inspection. Politics must not be mixed with electrical inspection work. "Graft" among municipal inspectors is rare. These inspectors should be paid better than they are. Losses from fires due to electrical causes are decreasing in all cities where there is municipal inspection on a rational basis, but the electrical fire loss can be reduced to a nominal amount with the present-day excellence of electrical fittings. Mr. Boyd's paper was heartily commended by the members. A vote of thanks was given to the author, and he was made an honorary member.

UNDERGROUND CABLES.

Mr. Loomis discussed the general subject of underground cables for fire and police telegraph service. He said that his experience with saturated-fiber cables had been satisfactory. A recent improvement makes this type approximate a rubber-insulated cable in moisture-resisting qualities.

CONVENTION NOTES.

Thirty-six new members were elected, including twenty-two active members and fourteen associate members.

Captain William Brophy, of Boston, one of the oldest members of the association, sent in his resignation, but the association refused to accept it and elected him an honorary member for life. Mr. Will Y. Ellett, of Elmira, N. Y., paid a glowing tribute to Captain Brophy and his work.

A committee was authorized to report on the general subject of permissible limits of voltage within the bounds of municipalities.

Officers were elected as follows: President, Mr. John W. Kelly, Jr., Camden, N. J.; vice-presidents, Messrs. O. C. Trussler, Indianapolis; W. R. Arbuckle, Bayonne, N. J., A. G. Sangster, Saskatoon, Sask.; B. A. Blakey, Montgomery, Ala.; secretary, Mr. Clarence R. George, Houston, Tex.; treasurer, Mr. C. E. Diehl, Harrisburg, Pa.; executive committee, Messrs. H. C. Bundy, Watertown, N. Y.; T. C. O'Hearn, Cambridge, Mass.; Will Y. Ellett, Elmira, N. Y.; W. E. Wolgamott, Peoria, Ill.; A. L. W. Kittredge, New Haven, Conn.; Clayton W. Pike, Philadelphia; H. A. Boneen, Cleveland; W. B. Martin, Albany; John Berry, Indianapolis, and Robert J. Gaskill, Fort Wayne, Ind. The election was enlivened by a contest over the secretaryship. Mr. George wished to retire, owing to pressure of other duties, and several candidates were placed in nomination, but Mr. George was re-elected by a large majority and consented to serve.

The entertainment program included a high-voltage demonstration by Mr. J. W. Kelly, an enjoyable boat ride on the Illinois River and several other features.

Seven candidates were initiated into the mysteries of the Sons of Jove at a rejuvenation held on the night of Aug. 28. Among these were two ex-presidents of the association. The degree team was composed of Mr. V. L. Crawford and Messrs. Driscoll, Dubsky, Lyons and Friend, of Chicago. This was the first rejuvenation of the order held at a convention of the municipal electricians.

It was voted to hold next year's convention of the International Association of Municipal Electricians in Watertown, N. Y.

AN ORGANIZED MOVEMENT TOWARD CO-OPERATION AND EXPANSION.

The meeting held at Association Island, Lake Ontario, on Tuesday, Sept. 3, was a "co-operation" gathering of more than 100 representatives from four divisions of the field—the central stations, the manufacturers, the jobbers, and the contractors and dealers. The purpose of the meeting was to consider means for bringing about more systematic and harmonious relations among the several factors having to do with the sale, distribution and installation of electrical service and facilities. The result of the meeting was a decision to create an organization to cary on a co-operative movement throughout the country. That decision took form in the election of an executive or organization committee composed of the following:

From the National Electric Light Association:

Henry L. Doherty, Henry L. Doherty & Company.
J. E. Montague, Buffalo & Niagara Falls Electric Light & Power Company.
W. H. Johnson, Philadelphia Electric Company.
A. C. Einstein, Union Electric Light & Power Company, St. Louis.
J. F. Gilchrist, Commonwealth Edison Company, Chicago.

From the Electrical Supply Jobbers' Association:

W. E. Robertson, Robertson-Cataract Company, Buffalo, N. Y.
W. W. Low, Electrical Appliance Company, Chicago.
R. V. Scudder, Wesco Supply Company, St. Louis.
F. S. Price, Pettingell-Andrews Company, Boston.
Gerard Swope, Western Electric Company, New York.

From the National Electrical Contractors' Association:

Ernest Freeman, Chicago.
Ernest McCleary, Detroit, Mich.
P. N. Thorpe, Paterson, N. J.
G. M. Sanborn, Indianapolis, Ind.
James R. Strong, New York City.

From the Electrical Manufacturers:

A. W. Burchard, General Electric Company.
L. A. Osborne, Westinghouse Electric & Manufacturing Company.
W. A. Layman, Wagner Electric Manufacturing Company.
J. R. Crouse, National Quality Lamp Division, General Electric Company.
B. L. Downs, Hemingray Glass Company and president Manufacturers' Club.

Mr. Doherty was made chairman and Mr. Philip S. Dodd secretary of the committee. In accepting the chairmanship Mr. Doherty said that he proposed to go into this movement to make it a success. The committee held its first meeting before leaving the island on Tuesday and appointed a subcommittee on by-laws.

BOTH PUBLICITY AND BUSINESS METHODS CONSIDERED.

A formal program had been arranged for the meeting, the theme for which was publicity and advertising for the industry. It soon appeared, however, after general discussion of the set papers was reached that the problem was more than one of publicity alone. The long-standing question of adjustment and co-ordination between the lighting companies on the one hand and the contractors and dealers on the other, in the matter of creating new business, was soon occupying the middle of the stage. In brief, the jobbers, contractors and dealers were willing to co-operate if the central stations would give them what they considered a fair show, while the central-station representatives said they would be glad to give up all business in energy-consuming devices and in wiring the moment the contractors and dealers were prepared to handle such things as well as or better than the central stations can do it for themselves.

The meeting was opened by an address of welcome by Mr. A. D. Page, of the General Electric Company, who explained the object of Association Island as a co-operative meeting place. He said that those who had used it for a number of years had found the results gratifying, and that competitors or rivals who, in the informal intercourse of play and recreation, met each other with the mask off found it subsequently more difficult in business relations either to lie to or disbelieve one another. Mr. Page introduced Mr. F. M. Tait, president of the National Electric Light Association, who delivered the first address of the meeting. Mr. Tait discussed the question of "What Co-operative Effort Can Do for the Electric Lighting Industry and the Industry as a Whole." He reviewed the difficulties which beset central stations and local contractors and dealers in their mutual relations. He pointed out that sometimes local troubles arose from causes that were not local, and that many of these troubles could be adjusted or removed by some general co-operative movement, the purpose of which would be to stimulate local effort to advance the use of electricity by the consuming public.

At the conclusion of his remarks Mr. Tait was made permanent chairman of the meeting and he presided over the deliberations of the day.

THE JOBBERS' POINT OF VIEW.

Mr. W. E. Robertson, of Buffalo, spoke on behalf of the jobbers, who, he said, were in sympathy with any co-operative movement that would recognize the principles of sound merchandising and that would be entirely free from suspicion of being devoted to the interests of any special group. The jobbers were animated by the native caution of men who felt that in going into a co-operative movement they would be justified in doing it only to the extent that the execution of the scheme as a whole would benefit them individually. The sale of goods by the central stations at cost or for prices yielding less than a fair profit was not a basis of co-operation that would be attractive to the jobbers.

THE CONTRACTORS READY TO CO-OPERATE.

Mr. Ernest Freeman, president of the National Electrical Contractors' Association, spoke on "What Co-operative Effort Can Do for the Contractor" to the effect that if "pulling together" and "co-operation" meant the same thing he and the people that he represented were for it. He said:

"As a result of this kind of pulling together or co-operation, I can see the electrical contractor coming into his rights, but I am unwilling to admit that the results would be any more beneficial to the contractor than to the manufacturer, jobber or central station. It is my belief that the electrical contractor of to-day is in better position than ever before. I am convinced that he is a bigger business man and that through his associations and his personal push he is slowly but steadily coming into his own.

"By the joint publication of such things as the 'Electrical Equipment of the Home' and the 'Home Beautiful' I can see that the suggestions contained therein will tend to create a desire for conveniences the installation of which will increase the business of the contractor. I can see a chance by this method of showing the consumer that electricity is the best of all methods for illumination, for laundry work, for cooking and for hundreds of other things. I can see that the contractor will come in for his share of increased business as a result of such methods.

"If general publicity creates a demand for products, the contractor who does not avail himself of the opportunities offered by the 'people's electrical page' is indeed making a mistake. It seems to me that this is the place for the men in my line to spend money, because if a demand is created or a desire is instilled into the public mind for electrical apparatus the contractor must let it be known who he is and where he is in order that these demands and desires may be gratified. Certain it is that the contractor is the best one

to look to for these things, and it therefore behooves him to go to the limit in taking space in co-operative newspaper advertising."

THE JOVIANS AS CO-OPERATORS.

Mr. R. L. Jaynes, reigning Jupiter of the Sons of Jove, explained with some care the purposes of the order and its present condition, which is relatively prosperous. It now has about 8000 members and is in very comfortable financial circumstances. He felt that such a body, which was not organized alone for social and fraternal purposes but was especially intended to afford a means for carrying out practical methods of commercial co-operation, should in any question such as that under consideration be a very important factor. The order was nation-wide in its extent and should afford a logical means of arriving at a solution of a co-operative scheme in the electrical industry.

Mr. T. I. Jones, vice-president of the Commercial Section of the National Electric Light Association, was on the program to speak of the Commercial Section. In his absence Mr. Philip S. Dodd explained the work accomplished by the section during the last two years. This work is already familiar to the readers of the *Electrical World*.

HOW TO USE TRADE LITERATURE.

Mr. J. C. McQuiston, manager of the Westinghouse department of publicity, spoke on "Co-operative Publications." He went with considerable detail into practical questions pertaining to the use made or to be made by dealers and central stations of printed matter furnished at the expense of manufacturers. He outlined what he would do if he were a dealer, remarking that the same care should be exercised in distributing the printed matter provided by the manufacturer as if the local interest paid for it. Too often the publications furnished by the manufacturers are not appreciated by the dealer because no charge is made for them. If those same publications were printed by the dealers or central stations at their own expense greater pains would be taken to get them into the hands of people who would be most likely to become purchasers. The local salesman should read and reread any and all literature which has a bearing on articles on sale. If a salesman cannot make a sale with the article itself in his hands it cannot be expected that a piece of literature, however attractive, can do it for him. Of far greater importance than the literature given out is the treatment of the display. If a woman goes into an electrical supply store and sees chiefly a display of sockets and dry batteries and wiring material the price for a coffee percolator seems too big and she wants to get away. A good display room might be likened to a carefully planned catalog. All of the articles are arranged on neat tables, inviting the inspection of the customer, and the artic'es in greatest demand are placed in the rear of the store, so that the customer desiring an electric iron, for instance, must pass tables filled with chafing dishes, samovars, percolators and toasters before she comes to the irons. The proprietor of this display room has little need for printed literature, for the whole display room is an open catalog illustrated by real articles instead of pictures. The dealer should get the best mailing list obtainable and see that it is always kept up to date. The expense of mailing is a big item, and from the list should be cut all names that could not be counted as of real prospective customers. Instead of a list of 1000 names to receive third-class mail matter it would be better to select the best 500 and use 2-cent stamps.

"Co-operative Publicity" was the subject of a paper presented by Mr. Frank H. Gale, advertising manager of the General E'ectric Company. After sketching briefly the history and nature of publicity work in specialized and technical fields, Mr. Gale said that the situation in the electrical business points to the value of an independent publicity organization supported by the industry at large. "Such an organization must observe strictly the trade ethics in planning publicity either for newspapers, magazines or technical papers. The violation of a few simple rules will insure the failure of the desired publicity. Publications should not be expected to print advertising matter free of charge. Nothing but straight, legitimate news and good educational matter should be supplied. Publicity should never be considered in connection with advertising space. No publishers should be approached with a proposition to insert a small advertisement and get a large free news article on the subject. If the material is something the readers will like, the editor will be glad to publish it. Petty tricks and dishonesty should never be resorted to for the sake of a few lines of free publicity.

THE FIELD IS RICH IN PUBLICITY MATERIAL.

"Great inventions, new methods, enormous undertakings, novel installations and the prominent part taken by electricity in the wonderful progress of to-day all offer abundant material for the publicity man working in the interest of the industry at large. Material supplied by the publicity bureau must be written in an entertaining way without technical terms. There is an abundance of technical literature available but a scarcity of that which the layman can understand.

"The publicity bureau under consideration should come out into the open and should endeavor to be recognized by writers and editors everywhere as a source of reliable news on electrical subjects. It should be especially equipped for furnishing data to free-lance writers, of whom there are many in the country at present interested in the subject of electricity. It should be prepared to supply notes on electrical subjects for use by local lighting companies whenever they are themselves unable to keep their local editors supplied with sufficient material of that sort.

"The first duty of this bureau is the work in connection with the so-called 'people's electrical page.' About forty of these pages are now being published in various cities. The local co-operative electrical page has great local advertising value, but its success depends upon the quality of the material published as reading matter. A certain part of the space should be devoted to local electrical notes, but there is no reason why a considerable part of it should not be supplied from a central bureau, and there is certainly no objection to the same matter appearing simultaneously in the electrical pages published in all the different cities.

WHAT A CO-OPERATIVE PUBLICITY BUREAU MIGHT DO.

"A co-operative publicity bureau should undertake the management of these electrical pages in all of the different cities, maintaining a traveling representative who could personally keep in touch with each situation. While the bureau could and should be of very great help in organizing and conducting these electrical pages, it should not be called upon for financial support for such pages. The local electrical page is of great value as a stimulus for closer co-operation among local electrical interests and this is at once removed when outside financial support is accepted."

In summing up, Mr. Gale said that a co-operative publicity bureau would be able to supplement in a very effective way the work at present carried on to a greater extent by lighting companies, dealers, jobbers and manufacturers, and without interfering in any way with their efforts would be able to distribute to the reading public a vast amount of educational material on the subject of electricity which in due time would not fail to increase the general interest in the use of electricity and thereby become profitable to all.

Mr. Roger V. Scudder, of the Wesco Supply Company, St. Louis, read a paper outlining briefly a plan for co-operative advertising service which dealt with suggestions as to ways and means whereby the interests concerned can apply to local needs material and plans created co-operatively.

"The Co-operative Newspaper Page" was the subject of a paper presented by Mr. Frank B. Rae, Jr., publisher of *Electrical Merchandise*. Mr. Rae stated the three objects of the people's electrical pages to be:

First, the education of the public in a wider use of electric service (which means also the more general use of all manner of electrical appliances); the elimination of prejudice against the supposed high price of such service and appliances; the overcoming of the fear of electricity both as a fire risk and as an agent of personal injury; the combating of the carefully nurtured hatred of public-utility companies, and, finally, opposing the municipal-ownership idea.

Second, the "people's electrical page" is designed to bring local electrical interests together in harmonious effort toward a definite end.

Third, the "people's electrical page" educates local interests in the value of advertising and developing their own business.

Mr. Rae said that the two parties most interested in the "people's page" are the central station and the newspaper. But the factor that makes most directly for success is the harmony club—be it lunch club, Jovian club or whatever form the harmony movement takes.

HOW TO HANDLE THE PEOPLE'S PAGE.

"To start the 'people's page' it should be presented to the harmony club as a definite object and such impetus should there be given the movement that the local interests will all be definitely committed to it. From this point of commitment the newspapers should become responsible for the actual solicitation of advertising, should co-operate in the preparation of copy and should be charged with the detail work. The central station should always be the largest advertiser and should provide if necessary the funds used to procure the educational articles and news items from the co-operative copy bureau designated above.

"With this copy bureau definitely interested in the sale of its product, with the newspaper definitely understanding that it must solicit this advertising and render services just as it solicits and renders service for the shoeman or the department store and with the central station aggressively leading the procession of local interests with adequate space and by meeting the cost of the educational copy—with such a division of work and with the harmony club as the mainspring of the movement, there can be no doubt of the success of any 'people's page' anywhere."

Mr. H. H. Cudmore, general manager of the Brilliant Electric Works of the General Electric Company, discussed "Harmony Luncheon Clubs and Electrical Leagues," pointing out what had already been accomplished in this line of work and how much more remains to be done. He laid emphasis upon the necessity of work upon definite objects in the activities of these more or less informal organizations.

At this point in the proceedings the question of organizing a co-operative movement was thrown open for general discussion.

INTELLIGENTLY DEVISED PLAN IS PRACTICABLE.

Mr. A. W. Burchard, of the General Electric Company, stated that the idea of co-operation was directly in line with the methods demanded by modern progress. Organized effort properly directed is more efficient than individual effort. The difficult question to solve in every plan of the kind is the harmonization of the diverse interests involved and the avoidance of clashing personalities and jealousies. He felt, however, that the things in which the different groups had identical interests would preponderate over those in which they had conflicting interests, and that by mutual concession and the subordinating of trivialities the greatest good for the industry as a whole could be accomplished by an intelligently devised scheme of co-operation.

Mr. S. L. Nicholson, general sales manager of the Westinghouse Electric & Manufacturing Company, spoke briefly and said that he believed in co-operative organization for the good of the industry, and that if the good of the industry as a whole is to be subserved in good faith the Westinghouse company will be glad to help in the organization of the movement and to co-operate in the fullest degree in making the undertaking a success.

A BASIS THE FIRST REQUISITE.

Mr. Gerard Swope, of the Western Electric Company, said there is no difficulty in getting together on the general theory of co-operation, that there is little dispute on the desirability of co-operation, but it will be necessary to have a definite understanding as to the object of the co-operation. In Cleveland, where all parties in interest had a mutual understanding, it was easy to co-operate, and the Western Electric Company was glad to spend money under such a plan, but where the central stations are not selling goods on a merchandising basis it is impossible for the jobbers, contractors and dealers to co-operate. He believed that the jobber performs in the distribution of goods an economic service for which he should be paid.

Mr. F. R. Cagwin, secretary of the Electrical League of Cleveland, explained the workings of the organization in Cleveland and the satisfactory results obtained. He expressed the conviction that the league would accomplish still greater good in the adjustment of differences in the future.

Mr. Z. W. Carter, of the Pettingell-Andrews Company, Boston, told of the recent organization of the Electrical Development Association in Boston by the contractors and jobbers, and of the relations of the association with the Boston Edison company, which had resulted in the local contractors and dealers pursuing a much more vigorous policy in the matter of marketing fans, irons and other devices than they had pursued before. The Boston Edison company was about to put fans and irons on the market at inviting prices, but when the company was assured of the increase in activity these plans were changed.

REMOVE ANTAGONISM BETWEEN CENTRAL-STATION DEALERS.

Mr. W. E. Robertson, resuming the floor and referring to Mr. Rae's paper, said that the first electrical page was not started for love of the central station but because the individual contractor or dealer advertising alone could not afford an expenditure sufficient to make an impression on the public. In order that the proper impression should be made they had to join hands and take adequate space to present their needs. He stated further that the jobbers and dealers did not propose that the central station should retire from the business of selling apparatus unless the business of selling apparatus could be conducted by the jobbers, dealers and contractors at least as efficiently and in as large volume as by the central station. He conceded that the central station was entitled to its full measure of expansion, but as the jobbers have $25,000,000 or more invested in their business they cannot be expected to favor the central stations if the central stations antagonize them. Antagonism on the part of the central station would force jobbers and contractors to favor municipal ownership, isolated plants or other means through which they might be able to find business. He considered that the syndicate control of central stations, if carried to an extreme, may mean the elimination of the jobbing business entirely.

Mr. A. D. Page, of the General Electric Company, called attention briefly and forcefully to the fact that co-operation so far as the local dealer and central station is concerned is purely a question of getting together and solving their local problems, and that co-operation of a national character had to do with fostering those ideas and desires that would tend to extend the use of electricity among the people.

DOHERTY ON GIVING THINGS AWAY.

Mr. H. L. Doherty, of New York, said that, while he held no brief for either jobbers or manufacturers, he did not believe in selling goods at less than cost. The central station and everybody else in handling electrical apparatus should handle it at a reasonable profit. He cited his ex-

perience in the gas business in illustration of the futility of doing business without profit. While in Madison, Wis., where he had charge of a gas and electric plant a number of years ago, he changed the policy of the company with regard to making free service connections and giving away gas stoves, and by taking two-thirds of the receipts from that source and applying them in a way to make people want to buy his goods he was able to sell more gas stoves than another company owned by the same parties was able to give away in an Eastern town that was larger than Madison. Mr. Doherty expressed his hearty sympathy with the general idea of a co-operative movement and said that he had been in sympathy with it ever since the original proposal by Mr. J. Robert Crouse made at the Electrical Development Association meeting in 1906. Speaking for his own central stations, Mr. Doherty said that he would be glad to leave the selling of electrical goods and the wiring of buildings to the dealers and jobbers the moment that he became convinced that the dealers and jobbers could handle the business with equal efficiency. He contended, however, that the dealers and contractors must be able to hold their own people in line and avoid poor work and other improprieties which get the central station into ill repute with their customers.

EXPERIENCE AT NIAGARA FALLS AND ST. LOUIS.

Mr. J. E. Montague, of Niagara Falls, explained the difficulties that he had experienced in trying to induce the dealers of his community to obtain the business. He expressed himself as desiring not to sell electrical goods or to do wiring and glad to enter into any co-operative arrangement which will insure to the central station through the proper activity on the part of the supply dealer and contractor the full development of business that the central station may reasonably expect.

Mr. C. A. Einstein, of St. Louis, said that in his experience the chief difficulty was that the contractor was lacking in capital and push, and that in St. Louis his company had shown its belief in co-operation by going so far as to outfit dealers with stock and to assist them in other ways to develop their business. He had proposed to the contractors to carry their customers' accounts, but neither the dealers nor the contractors had embraced the opportunity and made the most of it.

THERE ARE SOME RESPONSIBLE CONTRACTORS.

Mr. E. McCleary, of Detroit, stated that while he appreciated the force of the remarks made in criticism of contractors and their failings, he knew of some successful contractors. The time was when many contractors and dealers did not have capital adequate to carry on their business, but any of them are in better circumstances now. He felt that the practice of public-service companies conducting the business of merchandising was impolitic. The contractors and dealers are the logical and proper parties to conduct such business. He believed that if each party were made to underestand the others' point of view there could be developed a plan of co-operation that would solve the problem.

Mr. Gerald Swope, of the General Electric Company, said that if the attitude of all central-station managers was the same as that of Mr. Doherty there would be no trouble, but that some of them are selling goods below cost.

Mr. H. H. Cudmore, of the Brilliant Electric Works, stated that in the organization of luncheon clubs he had not advised the central-station companies to stop selling goods but that he had urged contractors and dealers to perfect themselves in sales methods so that they would gradually equip themselves to handle the business and relieve the central stations of the need of engaging in it.

Mr. C. A. Littlefield, of the New York Edison Company, who also represented the Association of Edison Illuminating companies at the meeting, explained the results of the experience in New York where the company does not engage in the contracting or the supply business. He said that the company was satisfied with its experience. He called attention, however, to the dangers that follow when the contractors pursue a mistaken business policy and exact prices for their work that are not justified and that deter the best development of the business.

Mr. R. V. Scudder, of St. Louis, said that for the purpose of argument it might be admitted that the contractors and dealers in the past have not had adequate capital and that at present they may be lacking in financial resources, but that in the future it is conceivable that they will be able to take care of their business in this regard. He expressed the opinion that where a central-station company is engaged in selling goods it is more than likely that some of the cost of that part of its business will be absorbed in its overhead charges, and that the basis of comparison between the cost of merchandising on the part of central-station companies and the cost of doing the same business by independent dealers will thereby be vitiated.

Mr. Henry Dwight Smith, of the Fuller & Smith Advertising Agency, of Cleveland, stated that men engaged in the discussion to which he had listened did not realize how far they had gone on the pathway toward co-operative effort. The spirit of the discussion was to his mind, the best evidence that a basis of co-operative effort was at hand. In fact, the discussion itself was a species of co-operation.

Mr. Philip S. Dodd summarized the situation as revealed by the papers and the debate. He suggested that some definite steps be taken to give expression to the ideas brought out at the meeting. On motion of Mr. J. E. Montague, it was unanimously voted to appoint a committee on plans and organization. In conformity with that action the organization committee named at the beginning of this report was chosen.

PUBLIC SERVICE COMMISSION NEWS.

MASSACHUSETTS COMMISSION.

The Railroad Commission has handed down decisions in several electric-railway fare cases which have been pending before the board. In each instance the petitioners urged that fares be reduced or that the existing fare zones be lengthened. In the petition of the Selectmen of West Newbury for a 5-cent fare between Haverhill and the former town the board recommended that this tariff be placed in effect between stated hours of the morning and evening for the benefit of regular patrons of the Bay State Street Railway. The railway company is to be allowed to raise the rates if those suggested prove unreasonably low. A similar reduction has been recommended by the board between Cherry Valley and Worcester on the Worcester Consolidated Street Railway.

OHIO COMMISSION.

Judge Brodrick, of the Common Pleas Court, at Bellefontaine, has rendered a verdict upholding a section of the public utilities law requiring that before a telephone company can build a competing toll line it must first secure the permission of the commission. The United Telephone Company of Bellefontaine brought suit to restrain the Farmers' Telephone Company from building a line between Degraff and West Liberty on the ground that it is already furnishing proper service and that the Farmers' Telephone Company had not secured the permission of the commission. The court upheld the claim.

Judge Gard in Common Pleas Court at Hamilton has rendered a decision to the effect that the Hamilton Gas & Electric Company has no right to charge 10 cents per month for the use of meters.

The commission has granted the request of the Cleveland

Railway Company for authority to issue $3,000,000 additional stock for the purpose of taking up a portion of a bond issue and making certain improvements.

MARYLAND COMMISSION.

The Maryland Public Service Commission has received a formal announcement that an amicable understanding has been reached under which the town of Centerville, Md., will purchase the plant of the Centerville Electric Company and will conduct it as a municipal enterprise. A large delegation of business men was on hand to represent the town when the announcement was made to the commission by Secretary of State Robert P. Graham, who is the receiver of the company. The plant was established in 1906, but has been in the hands of a receiver for the last two years.

WISCONSIN COMMISSION.

After an investigation extending over a period of more than three years, and involving what is perhaps the most complete cost analysis of electric-street railway operation ever undertaken, the Wisconsin Railroad Commission has issued its decision on the complaint of the city of Milwaukee against The Milwauke Electric Railway & Light Company, or the so-called "three-cent-fare" case. Five other complaints against The Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company are disposed of in the same decision.

In the application of the city for a reduction in the city fare, the commission held that the present practice of selling twenty-five tickets for $1 should be discontinued, and in lieu thereof the practice of the sale of thirteen tickets for 50 cents, with the usual transfer privileges within extended single-fare limits, should be established. The application for a universal double transfer was dismissed on the ground that there was no reasonable necessity for the extension of the double transfer. In the Weakin case, applying for a reduction in the rate of fare between the city of Milwaukee and the city of Waukesha, the commission held that the earnings of this line were too low to warrant any reduction. The application for single fares to West Allis, East Milwaukee and Wauwatosa were granted, and the single-fare zones on certain of the streets in Milwaukee were extended. A subsequent order is to be issued relating to the betterment of service.

In connection with the reduction of city fares the commission called attention to the fact that the burdens imposed by the municipality within the last two years have materially affected the city's own application, and they have rendered a 3-cent fare entirely out of the question. Among other things, it is estimated that the company will be compelled to expend from $150,000 to $250,000 annually as interest and depreciation upon the pavement between its tracks as a result of a paving suit recently decided in favor of the city. In connection with the probable future expenditures, the decision noted that the preliminary investigation of electrolysis conditions in Milwaukee, which is being carried on by the commission, indicates that considerable damage is taking place and that immediate measures of relief will be necessary.

A considerable portion of the decision is given over to a review of the company's financial history and to the determination of what should constitute a reasonable valuation for rate-making purposes. It was averred that the value upon which the company is entitled to earn a fair return should aggregate $20,546,930 on Jan. 1, 1907. The value finally allowed by the commission was $10,300,000 on Jan. 1, 1910. The cost of the reproduction new of the physical property aggregated about $9,942,125, and the present value $7,378,950. The commission was of the opinion that an allowance of not to exceed $500,000 should be ample for going value. The rate of return was limited to 7.5 per cent.

Current News and Notes

WASTED FUEL ENERGY.—Mr. Charles L. Parsons, chief mineral chemist of the United States Bureau of Mines, has written a pamphlet entitled "Notes on Mineral Waste," which has been issued as Bulletin No. 24 of the bureau. He estimates that nearly 90 per cent of the energy of the coal that is mined is wasted, while 250,000,000 tons of coal per year is left underground never to be recovered in the future. He states that more natural gas is wasted than the total output of artificial-gas companies. There is an annual waste of more than $40,000,000 in by-products in the making of coke by old-fashioned processes.

* * *

NATIONAL CHAMBER OF COMMERCE PUBLICITY.—The Chamber of Commerce of the United States, which has recently opened permanent headquarters in the Riggs Building, Washington, D. C., recently announced that on Sept. 2 it would commence publishing *The Nation's Business*. This periodical will be distributed from Washington to the editorial writers throughout the country and to members of the National Chamber of Commerce. The prospectus stated that the publication will furnish a survey of constructive progress along the lines of agriculture, mining, manufacturing, transportation, distribution and finance.

* * *

THE INVENTOR OF THE DYNAMO-ELECTRIC PRINCIPLE.—A pamphlet entitled "Soeren Hjorth, Inventor of the Dynamo-Electric Principle," written by Dr. Sigurd Smith, has recently been published by Messrs. J. Jorgensen & Company, of Copenhagen, and contains a very interesting account of the inventor's career. He was born at Vesterbygaard, Denmark, on Oct. 13, 1801, and early showed great mechanical genius, though for many years he was engaged mainly in purely business pursuits. He experimented unsuccessfully with the steam engine, but thereby gained the attention of Oersted. As early as 1842 he invented an electromagnetic machine, a full description of which is given in the pamphlet, but his ideas did not receive much encouragement. The principle discovered by Hjorth did not become of practical importance until some time after his death, a circumstance which was due partly to his inability to exploit what he had discovered. His claim to be the inventor, however, was subsequently widely recognized. The pamphlet is interesting historically as a record of the work of one of the earliest pioneers in electrical engineering. It is published in Danish and English.

* * *

STATUS OF THE GAS PRODUCER.—The United States Bureau of Mines, Department of the Interior, has just published a technical paper on "The Status of the Gas Producer and of the Internal Combustion Engine in the Utilization of Fuels," by Mr. Robert Heywood Fernald. Tests of two kinds have been conducted at the government fuel-testing plants, first with the pressure producer, and second with the down-draft producer. A more detailed account of these investigations is given in Bulletin No. 15, recently issued by the bureau. The more important facts and conclusions given in that bulletin are summarized in the present one, known as Technical Paper No. 9. The author states that a personal inspection of a large number of gas-producer installations warrants the conclusion that the plants as a rule are giving remarkable satisfaction, considering the brief period of development since this equipment was first introduced, and that, furthermore, the most serious difficulties seem to arise from a lack of thoroughly competent operators to run the plants, rather than from defects inherent in the plants themselves. The past year may be regarded as one of steady conservative progress and development in the field of the internal-combustion engine. Nearly 100 important gas-power problems are now under consideration by the Bureau of Mines as subjects for proposed investigations.

Western Union Messenger Girls.—It is reported that the Western Union Telegraph Company will replace the messenger boys employed in its Pittsburgh offices with girls, the change to take place at once.

* * *

All-Night Lighting for Halls in Tenement Houses.—A recent amendment to the municipal code of Chicago provides that in every tenement house over two stories high a lamp shall be kept lighted in the public hall on each floor during every night in the year from sunset to sunrise.

* * *

Extension of Chicago Automatic Telephone System.—It is estimated that the new automatic telephone service in Chicago, which is rapidly extending, will include 5000 stations in the Cottage Grove residence district this fall. It has also been predicted that the entire system will embrace 80,000 stations in two years.

* * *

Agitation for Indiana Public Utilities Law.—It is reported that State Senator B. B. Shively, of Grant County, Ind., has under consideration the preparation of a public utilities bill for introduction at the next session of the Legislature. He has already conferred informally with the State Railroad Commission and will recommend enlarging the powers of that body, to give them control of public utilities. The question of whether the term of franchises ought to be made indeterminate is under consideration, but no conclusion has been reached.

* * *

Park Lighting in Chicago.—A contract has been executed between the Sanitary District and the West Chicago Park Commissioners of Chicago whereby the former agrees to supply electricity for lighting Holstein Park, which is one of the smaller parks and is located near the corner of Western Avenue and Hamburg Street. The park commission agrees to install the necessary transmission line and transformer substation, taking the electricity as 4000-volt, three-phase, 60-cycle alternating current. The present load consists of about ten arc lamps and about 250 16-cp lamp equivalents in incandescent lighting. The rate is $1.25 per month per hp for arc lighting (all night and every night), an arc lamp being considered equivalent to 0.8 hp, and 1.25 cents per kw-hr. for incandescent lighting.

* * *

Side-Door Cars for New York Subways.—A new type of side-door car for the New York subways has been proposed in a report submitted to the Public Service Commission by Mr. Theodore Douglas, consulting engineer, New York, N. Y. The 51-ft. car proposed by Mr. Douglas will receive and unload its passengers through fifteen folding doors on each side, of jack-knife construction, divided in the center and opening outward. All doors will be connected to working rods operated by a trainman at either end of the car and may be opened or closed by a single movement. Seating capacity is provided for sixty-eight passengers, compared with forty-six in the present type of subway express car. Special attention has been given to obtaining better ventilation.

* * *

Montana Coal Fields.—Owing to the great activity which is now manifest in the Bull Mountain coal field, Musselshell County, Mont., the United States Geological Survey has made a careful estimate of the amount of coal in that field to supplement its geologic reports published in Bulletins 381 and 431. According to the present figures, the field originally contained in beds 14 in. or more in thickness 4,797,200,000 short tons of coal. A small part of this quantity has already been mined, but in comparison with the total coal content the amount removed is almost negligible. It should be remembered, however, that these figures are intended to include all the coal contained in this field and no allowance has been made for waste in mining. According to the present mining practice throughout the country probably only 60 per cent of the total coal in the ground is put upon the market, but it is hoped that in the future greater care and more efficient methods will enable the operators to recover a larger percentage, if not the total amount.

* * *

Proposed United States Bureau of Farm Power.—Congressman Rainey recently introduced in the House of Representatives a bill to establish in the Department of Agriculture a bureau of farm power. The bill provides that the bureau shall be under the direction of a chief to be appointed by the President with the confirmation of the Senate, at a salary of $6,000 per annum. It is the intention that this bureau shall investigate and report upon all matters pertaining to methods of furnishing power on farms, all labor-saving machinery adapted for farm use, and the employment of electricity, gasoline and steam in propelling farm vehicles and in operating plows, reapers, mowing machines, threshing machines and other implements used in agricultural work. It shall also be within the province of this bureau to pursue investigations into the uses of machinery and labor-saving devices in the dairying industry and into methods of heating and lighting farm buildings. It is the desire to have the bill carefully considered during the recess preceding the short session which convenes in December, when an effort will be made to enact it into a law.

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SOCIETY MEETINGS.

Sons of Jove in Connecticut.—A rejuvenation of the Sons of Jove has been arranged for Saturday, Sept. 7, at Sea Breeze Island, Bridgeport, Conn. A record attendance is expected.

* * *

Illinois State Electrical Association.—The next annual convention of the Illinois State Electrical Association will be held at the Jefferson Hotel, Peoria, Ill., on Oct. 22, 23 and 24. Mr. H. E. Chubbuck, of Peoria, is secretary.

* * *

Annual Jovian Meeting.—The annual meeting of the Sons of Jove will be held in Pittsburgh on Oct. 14, 15 and 16, the official headquarters being at the Fort Pitt Hotel, with the Seventh Avenue Hotel used for the extra crowd. In addition to the regular Jovian features a banquet limited to 500 covers will be served on Oct. 16.

* * *

Colorado Electric Club's Juvenile Day.—On Saturday, Aug. 31, the entertainment and athletic committees of the Colorado Electric Club held a "juvenile frontier day" at Elitch Gardens, Denver, entertaining all children who came in costumes. In the morning there was a parade starting from the club rooms in the Electric Building, and a prize of $1 was offered for the best "kid get-up" among the electrical men. Basket picnics were held in the Gardens, and the day closed with a theater party. Mr. H. B. Barnes acted as chairman of arrangements.

* * *

Old-Time Telegraphers.—The thirty-first annual reunion of the Old-Time Telegraphers' and Historical Association and the fifty-first anniversary of the Society of the United States Military Telegraph Corps will be held jointly at the Windsor Hotel, Jacksonville, Fla., on Oct. 22 to 24. Hon. William S. Jordan, of Jacksonville, Fla., is president of the Old-Time Telegraphers' Association, and Col. William Bender Wilson, of Holmesburg, Pa., is president of the military society. Mr. F. J. Scherrer, secretary, 30 Church Street, New York City, is making arrangements for the joint meeting.

WESTERN CANADA POWER COMPANY'S SYSTEM

Hydroelectric Development at Stave Falls, B. C., from Which Energy Is Transmitted to Vancouver and Into the United States.

Two 7500-kw Units Installed and a Steel-Tower Transmission Line, Carrying Two 60,000-Vol Circuits—Energy at 13,000 Volts Transmitted from Terminal Station at Ardley to Substations, Whence 2,300-Volt Circuits Emanate for Local Supply—Underground Armored Cable Distribution in Vancouver.

THE hydroelectric development of the Western Canada Power Company is designed for an ultimate output of 52,000 hp, although for the present equipment for only 26,000 hp has been installed. The generating plant is located on the Stave River, one of the tributaries of the Fraser, about 35 miles east of Vancouver and 6 miles from the Canadian Pacific Railway station at Ruskin. Stave River has its rise in a lake of that name located 7 miles above the generating station. The lake is about 9 miles long and has an average width of 1 mile. Around it and forming its watershed are glacier-capped mountains rising well above the timber line, and the available storage made possible by the intake dam erected at the power station is 14,000,000,000 cu. ft.

HYDRAULIC FEATURES.

The present undertaking consists of the installation of two 13,000-hp Escher-Wyss turbines and two 550-hp exciter turbines of the same make, connected by two 7500-kw and two 250-kw Canadian General Electric Company's generators. Provision is made in the completed intake dam for two more penstocks, and an average head of 90 ft. is obtained with a maximum of 100 ft. For the two units now installed the development comprises (1) a sluice dam 62 ft. high and 160 ft. long at the crest, consisting of four concrete piers 8 ft. thick, 32 ft. long at the top and 56 ft. long at the bottom, the five intervening sluiceways being 22 ft. wide and extending up to the top of the dam; (2) an intake dam of concrete 75 ft. high, 145 ft. long and 40 ft. wide at the top; (3) a wing dam of concrete connecting sluice and intake dams with crest length of 90 ft., height of 60 ft. and width at top of 13 ft.; (4) two main steel penstocks 14.5 ft. in diameter and 165 ft. long and two exciter penstocks 4 ft. in diameter and of slightly greater length; (5) a power house of concrete for two units 110 ft. long and 104 ft. wide, including besides the installation of the units mentioned above six 60,000-volt, 3000-kva transformers and switch gear; (6) a regulating weir 250 ft. long at head of tailrace; (7) excavation of tailrace in old river channel for length of 2000 ft. with a width at bottom of 60 ft.; (8) a blind slough dam consisting, for the two units, of three sluiceways 22 ft. wide and four concrete piers 25 ft. high and of similar design to those of the main sluice dam. For the four-unit plant these piers will be raised 20 ft. and eight more will be built, providing a corresponding increase in sluiceways.

The blind slough is an old river channel covered with timber, beginning above and ending below Stave Falls and lying a short distance to the east of the sluice dam. Either the whole or a portion of the river originally flowed through this channel and was diverted by the construction of beaver dams a long time ago. The channel is straight and large enough to carry the whole river into the existing main channel below the falls. A ditch has been dug through this channel to form a lead to the flood water.

The blind slough channel constitutes the reservoir spill-

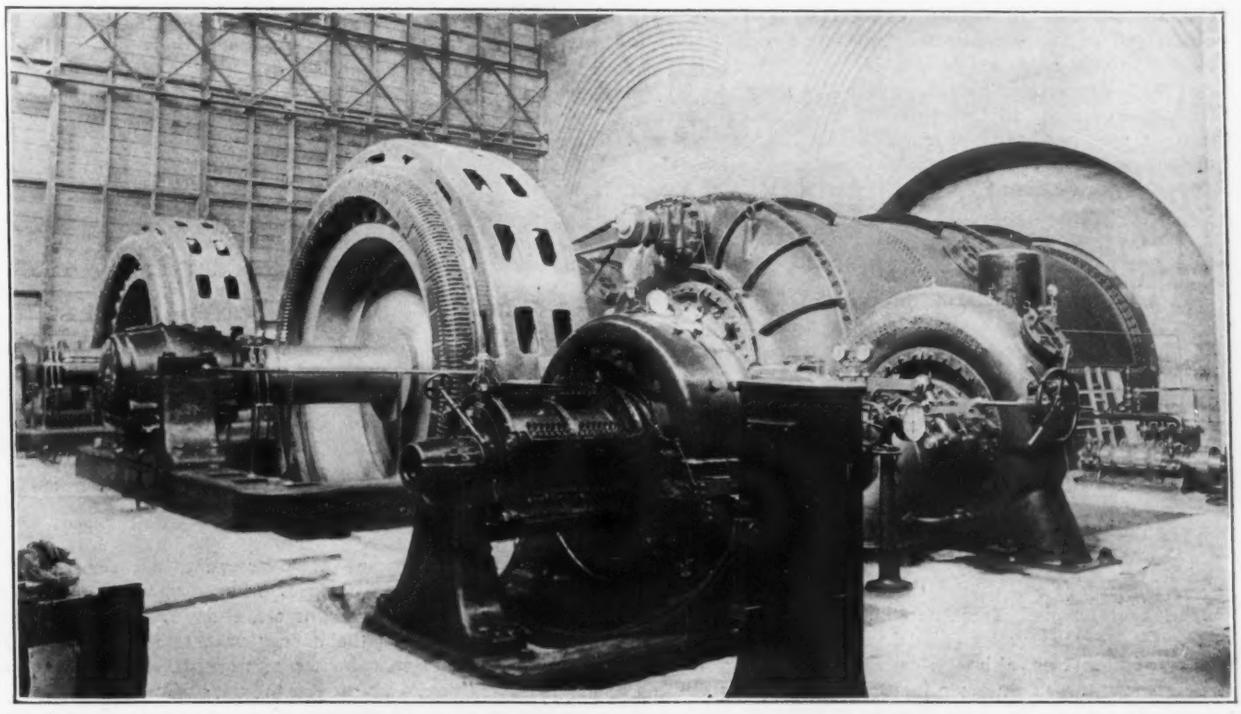


Fig. 1—Generating Equipment of Western Canada Power Company at Stave Falls, B. C.

way, the main river being boomed across south of its entrance and all logs and trash diverted through its channel to the main river below the works, and the reach between the blind slough entrance and the intake dam forms an ideal forebay. The four main sluiceways are operated with 24-in. wide stop logs and the remainder for the four-unit elevation will be operated with timber tainter gates. The

Fig. 2—Intake, Penstocks, Power House and Tailrace.

sluiceways, guides or checks in which the stop logs slide are of steel built into the piers. The winch form lifting and lowering the stop logs is operated by a 40-hp variable-speed alternating-current motor.

The main intake gates are of the balanced, radial pattern closing an opening 20 ft. square. Each weighs 35 tons, works on a pivot and is raised and lowered by electrically operated chains. Supplementary gates on the stop-log principle are provided upon the upstream side of the main gates.

The power house is constructed entirely of steel and concrete and one end is provided with a false wall which will be removed when the other two units are required and the power house is extended to double its present size. The draft tubes are designed on the water-seal principle so that the discharge is at all times in vacuo, to maintain which the 10-ft. weir has been constructed in the tailrace so that a sufficient water level is maintained to prevent access of air. A 60-ton electric crane spans the generator room and is available for use in handling parts of the turbines, generators or transformers.

TURBINES.

The two main units are each capable of developing 13,000 hp on the shaft under a head of 110 ft. when running at a speed of 225 r.p.m. The machines are of the double, horizontal Francis type with central discharge and weigh about 165 tons each. The governors, which are also of Escher-Wyss pattern, are of the high-pressure oil type, the oil required for their operation being supplied from pumps driven by independent waterwheels. The exciter turbines deliver 500 hp when they are operated at a speed of 500 revolutions per minute.

GENERATORS.

The generators are of the three-phase, horizontal, two-bearing type coupled directly to the turbine shafts. Each is wound for 4000 volts and delivers 7500 kw, at a frequency of 60 cycles, although capable of running continuously at 9375 kw, at a power factor of 85 per cent without the temperature rising more than 55 deg. C.

SWITCHBOARDS.

The switch gear was built by the Canadian Westinghouse Company and the layout has been kept as simple as possible, as experience has proved that most switchboards contain far too much costly apparatus, which tends to complicate operations and militates against continuous service. There are six 4000-volt main switches and four 60,000-volt oil switches for the two generators, two banks of transformers and two transmission lines. Aluminum-cell lightning arresters are used to protect the station apparatus.

TRANSFORMERS.

The high-tension transformers are of the Canadian General Electric make. Six 3000-kw units have been provided, and these are of the water-cooled, oil-insulated type wound to step up the generator potential to 60,000 volts. They are located in separate concrete compartments to one side of the generator room under the crane. The compartments are closed at the top by steel hatches and small doors are provided to give ready access for inspection. The transformers are not, as is commonly done, mounted on a truck on tracks, so that they can be wheeled out in case repairs are necessary. In such a contingency they are lifted bodily out of their compartments by the crane. The drain pipes of the transformers are provided with quick-opening gates installed outside of the compartments so that in case of burn-out the oil may be discharged into the tailrace. A tap is taken from this pipe at a point between the main gate valve and the transformer for a 2-in. line, which goes to the storage and drying tanks.

STORAGE AND DRYING TANKS.

Three tanks are provided under the switchboard gallery, each of which holds sufficient oil for two transformers. The

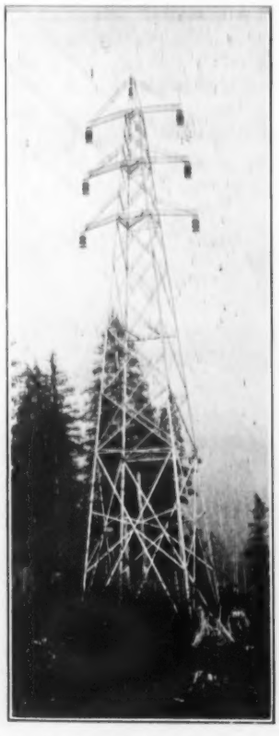


Fig. 3—Standard Tower.

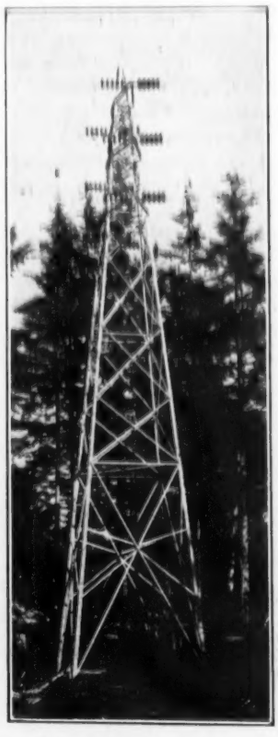


Fig. 4—Strain Tower.

oil is handled by means of a reversible air compressor, which acts either as a compressor or a vacuum pump, as desired. One tank is used for clean, dry oil, one for dirty oil, and the third for the drying process. In the drying process a 3-kw electric heater of rugged German make is employed and this is inserted in the tank of oil to be treated. A slight vacuum is maintained on the tank during the

process and a basket of calcium chloride is suspended in the top of the tank to absorb the moisture. Excellent satisfaction is obtained from the layout, which has also been used to advantage by a number of Mexican companies.

FEATURES OF ELECTRICAL LAYOUT.

In arranging the electrical equipment of the station the

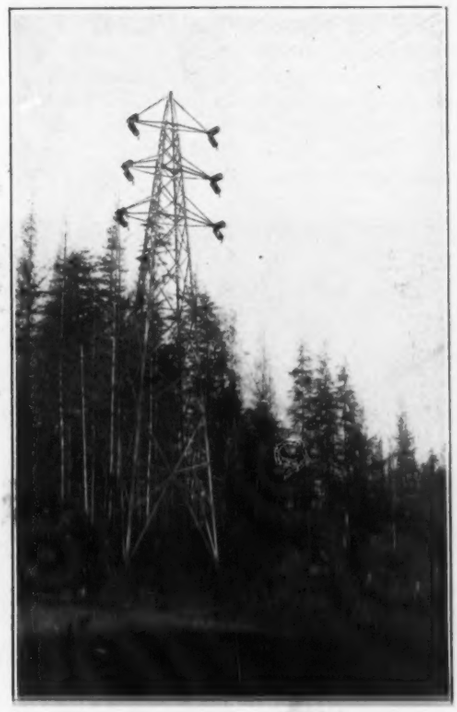


Fig. 5—Tower at Angle.

idea was to keep every piece of moving apparatus within sight of the operator at the control board, which is located at one end of the station directly over the exciters. The switches themselves are arranged in rooms separate from the main generator room. The main bus runs lengthwise of the station and the switches are set opposite the generators or transformer banks which they control, so as to call for as short a cable as possible and to have the cables of equal length.

The high-tension switches are of Canadian Westinghouse manufacture and each pole is separated from the other by reinforced-concrete barriers. The circuits from the switches to the bus are made with paper-insulated cables drawn into fiber conduit placed in the floor. The high-tension line exits are made through Ohio Brass Company bushings in the roof to a framework made up of 2-in. pipe and the lines pass thence to a terminal tower located on concrete piers in the tailrace about 25 ft. from the station. The choke coils, which were originally intended to be mounted below the disconnecting switches inside of the building, are placed outside on the roof immediately above the roof bushings. Copper tubing ¾ in. and 1 in. in outside diameter is employed for all high-tension wiring and time-limit relays are connected on the high-tension side.

LOW-TENSION WIRING.

The main leads running from the generator to the generator switch are made up of two 1,000,000-circ. mil varnished-cambric insulated cables per phase for each machine and are drawn through fiber conduit laid in the floor and the end walls. The neutral is brought out through a disconnecting switch located in the generator pit and is carried to an individual ground for each generator. In operation the neutral of only one generator is grounded at a time in order to avoid cross-currents.

The 4000-volt switching scheme is designed for a double bus, although at present only a single bus is installed. The separation of the cables from the single run from the generators to the double run to the switches for both busbars is made through a short bus of strip copper mounted on the wall in a reinforced-concrete compartment. The delta connection on the low-tension side of the main transformer is made in the same manner. Shunt transformers and fuses are also mounted in separate concrete compartments above these individual busbars.

The switchboard itself and panelboards are all controlled with direct current taken from a connection to either exciter made ahead of the main exciter switches through a double-throw switch mounted on the panelboard. This control bus also supplies the 8-hp direct-current series motors for operating the radial gates at the entrance to the penstocks.

TRANSMISSION LINE.

Although not of great length, the Western Canada Power Company's steel-tower transmission line has the distinction of being the first of its kind in British Columbia. The main line, which is 32 miles long, terminates at Ardley, a point on the Great Northern Railroad about midway between Vancouver and New Westminster. Two three-phase, 60,000-volt circuits are carried on either side of the towers, the conductors being composed of No. 0 hard-drawn stranded copper with hemp center and a 3/8-in. galvanized-steel ground wire being carried along the tops of the towers The height of the towers is 59 ft., which brings the lowest conductor 41 ft. above ground. The standard span is 660 ft., but different spans are oftentimes used owing to inequalities in level of the ground.

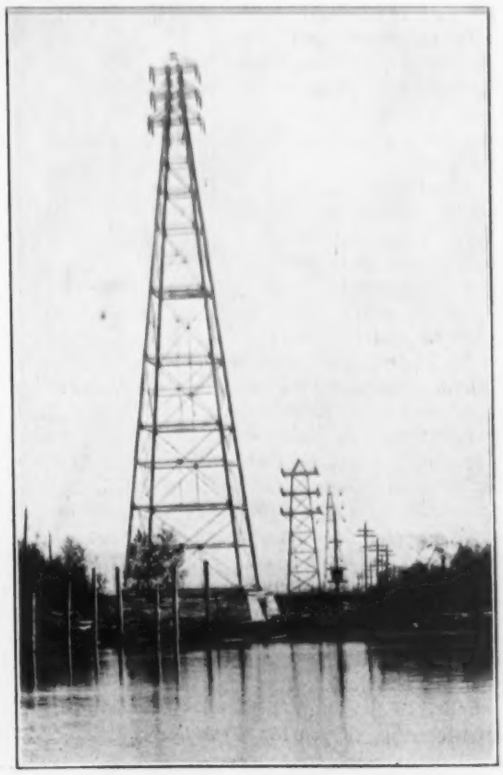


Fig. 6—Transmission Lines Crossing Pitt River.

The standard towers were designed to withstand a strain of 2000 lb. in any horizontal direction at any point of support for the lines, or 8000 lb. in any horizontal direction on the tower as a whole at the center of gravity of the points of support. The vertical loading is 1500 lb. on each point of support, or 9000 lb. on the tower as a whole. At dead ends or sharp corners anchor towers are used, capable of

withstanding twice the strains of the standard towers. The latter towers have angle-iron posts set 6.5 ft. into the ground, bolted at the bottom to a cross of angle iron, the holes being loaded and tamped with stone and rock. The anchor towers are provided with castings for feet which are bolted to a concrete foundation. The standard tower weighs 2515 lb. and the anchor tower about 4000 lb.

The line traverses a rolling country, heavily timbered in parts, and a clearance of 600 ft. in width was made on certain sections of the right-of-way where trees as high as 275 ft. and 9 ft. in diameter were encountered. By an agreement with the provincial government the right-of-way is on the Dewdney Trunk Road for some distance, the center line of the towers being 7 ft. from the north boundary of the road, throwing the legs of the towers and the wires themselves about a foot south of the property line. Several creeks and gulches are crossed, and in one case the span on standard towers runs up to 1020 ft.

Fourteen miles from Stave Falls the line comes out on the Pitt Meadows, a flat, grassy delta which was formerly flooded every year by the Pitt River. The government had diked the river and installed pumping stations to take care of the flood water, but the plain is still quite marshy so that piles had to be driven for foundations for the towers. The piles average about 18 ft. in length and are capped with 6-in. by 8-in. cedar timber. A special foot was designed to meet the conditions and the towers were bolted directly to the timber.

The Pitt River, a navigable stream, is crossed on a span 1360 ft. long. In order to provide a clearance of at least 100 ft. above the stream a galvanized-steel tower 165 ft. high over all and 140 ft. from ground to lowest wire was placed on concrete and pile foundations just outside the dikes on each bank of the river. A rocker tower set to give an angle to the main line of about 45 deg. is the starting point of the line wires. This rocker tower is securely guyed by 1-in. steel cables to a concrete and pile anchor. The main span is dead-ended at the rocker tower on each side and is free to move longitudinally on the supports of the main tower, so that these act simply as struts to afford height and have no strain due to the line itself. The main cables are of ½-in. plow steel. It was necessary to hang two sets of insulators in parallel, connected with compensating links for each point of support and for the dead ends of this crossing, as the strains were too heavy for a single set of insulators. All of the insulators and hardware were supplied by the Ohio Brass Company, Mansfield, Ohio, three of the 10-in. suspension disks being used on straight-line construction and four disks on strains. The towers were constructed by the Riter-Conley Company, Pittsburgh, Pa.

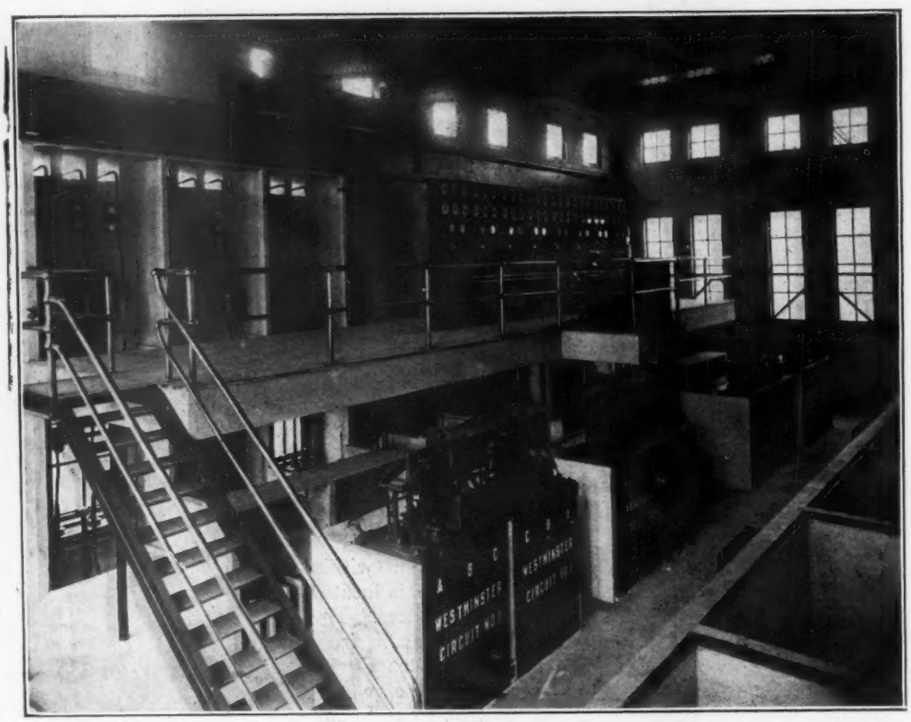


Fig. 7—Switchboard, Oil Switches and Transformer Compartments in Ardley Terminal Station.

TERMINAL STATION AND SUBSTATIONS.

The terminal station at Ardley is equipped with six 60,000-13,000 volt transformers, the arrangement of which follows closely that of the transformers at the generating station. Six 13,000-volt circuits leave the station as well as a 2300-volt line for local supply. The general arrangement of the station is well shown in the illustrations reproduced.

Substations for stepping down the potential from 13,000 volts to 2300 volts are located at Abbottsford, Clayburne, Matsqui, Mission, Ruskin, Nicomen, Port Hanly, Coquitlam, Sapperton, Ardley, Vancouver and New Westminster, the latter cities possessing two. Besides a line to Port Moody, the company has also under construction a wooden-pole 60,000-volt line to the international boundary at Sumas, at which point the Whatcom County Railway & Light Company has contracted for the purchase of power in blocks up to 5000 kw. From Sumas to Bellingham, Wash., is 23 miles and a 60,000-volt line has been erected between the two points, making the line from Stave Falls, B. C., to Bellingham, Wash., about 50 miles long. This line is almost complete, and when in service the Stave Falls station will operate in parallel with the system of the Whatcom County Railway & Light Company.

LOCAL DISTRIBUTION.

The 13,000-volt lines come into the substations over 50-ft. wooden-pole lines, which also carry back 2300-volt distribution circuits. The distribution in the business section of Vancouver is by means of steel-taped armored cable laid directly in the ground without conduits. The three-phase cables used are made up of No. 00 copper and placed 30 in. below the surface. Tie connections are provided at intervals and some sectionalizing boxes installed in very shallow manholes. Underground transformers are located in vaults of buildings which the company supplies. In some cases for factory distribution it has been found advisable to place the transformers on double pole racks, bringing the feeder cable up the pole. The secondary is then taken overhead to the various buildings. The 13,000-volt line at Mission crosses the Fraser River in a submarine cable 1950 ft. long.

The officers of the Western Canada Power Company are as follows: Mr. C. H. Cahan, Montreal, Que., president; Mr. A. R. Doble, Montreal, Que., secretary-treasurer; Mr. R. F. Hayward, Vancouver, general manager and chief engineer; Mr. William McNeill, Vancouver, assistant manager; Mr. John Montgomery, Vancouver, contract agent, and Mr. Frederick D. Nims, Vancouver, electrical engineer.

STREET LIGHTING IN TORONTO, ONTARIO.

Five-Lamp Standards Used in Business Section and Individual Lanterns in Residential Section.

Tungsten Multiple Lamps Used Exclusively for All Public Lighting—Underground Distribution in Business Section and Concrete-Pole Overhead Lines in Residential Section—Features of the Installation.

By K. L. Aitken.

IN laying out an entirely new system of public lighting for a modern business and residential city it is questionable whether one is justified in trying to strike the absolute minimum of illumination which may answer a given purpose. Too close figuring may prove to be a mistaken policy. Moreover, concentration of the light in a few large units can no longer be justified in the present state of the art. The esthetic side of an installation deserves, and nowadays is receiving, reasonable attention, and the vital fact that the illumination must not blind the observer is also being recognized.

Toronto is a modern city in the Province of Ontario, Canada, having a population of over 400,000 and possessing over 400 miles of streets. Prior to the installation about to be described, the streets were lighted with 1700 9.6-amp direct-current series open-arc lamps, usually located at street intersections in the business section, but more widely separated in the outlying districts. The energy was supplied by the Toronto Electric Light Company.

When the Hydro-Electric Power Commission of Ontario commenced operations the city of Toronto contracted for electrical energy and began the installation of its municipal system, of which the writer was appointed general manager. The first work undertaken was the design of a completely new street-lighting installation, and in this work the determination was to do something which would be worth while. It will be understood that the power from Niagara Falls comes to Toronto in 25-cycle form, which at the time seemed to indicate that constant-current apparatus and rectifiers, or motor-generator sets, would have to be installed. It was also felt that the metallic-flame arc lamp was fairly good for general lighting purposes, but the municipality was not satisfied that its use would result in the best system of illumination obtainable. The engineers of the Toronto Hydro-Electric System were entirely without prejudice in the matter, and had the writer been convinced that the arc lamp was the best type of illuminant available, it certainly would have been adopted. Arc lamps, particularly the modern ones, are esentially high-candle-power units, and their installation would mean that some portion of the street would be over-illuminated and other parts would remain virtually black.

Much photometric work was done with five-lamp cast-iron pillars, using 100-watt tungsten lamps covered with glassware of every description. A system of this kind seemed to give considerable promise for the central section of the city, as did also a system employing single 100-watt lamps mounted on goosenecks, bishops' crooks, etc., for illuminating the residential section of the city. The investigation appeared to be along the right lines and a system of this kind to be so far superior to any arc system that it was felt that further experimentation was abundantly warranted.

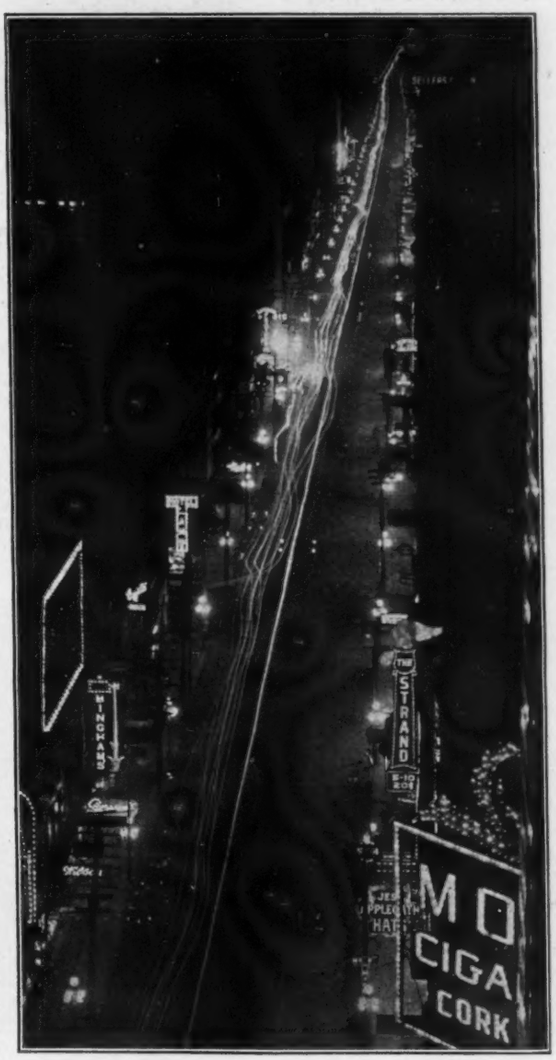


Fig. 1—Five-Lamp Standards on Yonge Street.

At the request of Mr. Alex. Dow, of Detroit, who at that time was acting as the consulting engineer for the Toronto Hydro-Electric System, the writer paid a visit to Boston and frankly admits that he saw there the best arc lighting he had ever seen. The 6.6-amp metallic-flame lamp with translucent glassware is without doubt a superior unit, and the yellow-flame lamp has unquestionably great capacity for producing light; but the system in Boston, like all arc-lighting systems, may be best characterized by the word "cold," and a "cold" system was what the city of Toronto desired most to avoid. From Boston the writer went to Indianapolis, and, although he arrived in the city very late at night and much fatigued, the five-lamp tungsten columns attracted his attention. Although there were few people abroad, the streets seemed alive in that they were bright without any glare. Moreover, the effect was "warm," and inasmuch as this was what was sought, the writer returned to Toronto thoroughly convinced that for the central section of the town, in which the prevailing system of distribution was of the underground type, the five-lamp column, using 100-watt tungsten lamps, would without any ground for question furnish a really ideal method of illumination.

The type of post for the residence streets was not so easily determined upon, although, of course, having adopted the tungsten lamps for the downtown sections, nothing else was considered for the rest of the city. It was decided to use on both sides of the street 100-watt lamps spaced 100 ft. apart, but the problem which confronted the municipality's engineers was how to arrange a suitable mounting for the lamps. It might be of interest to note in this connection that, as in almost all municipal projects, the people voted for one thing and then wanted another. Money was appropriated for an overhead system, but work had scarcely begun when there was a cry to have all the wires placed underground. Unfortunately, with the funds at the disposal of the engineers this was impracticable. As a compromise, however, it was determined to design an overhead system which would be neat and unobstructive, eliminating the usual objectionable features which are supposed to be inherent in overhead work.

About this time a salesman appeared on the scene with dozens of photographs of Western cedar poles. These all stood neat and trim and straight as ramrods, aligned with a perfection which would do a British regiment credit. The writer's experience up to this time had been limited to the crooked, corkscrew poles which grow in Eastern swamps, possessing large butts and loading about fifty to a car. A carload of Western cedar poles was accordingly ordered, and when the 121 long, thin, untapered poles arrived some notion of how an overhead distribution system which would not prove thoroughly objectionable could be erected was obtained. It was concluded that if the poles were very straight and were perfectly aligned one great difficulty would be overcome. It was also concluded that if the poles were made as short as possible, so as not to stand out against the sky line, a second point would be gained. And as a third consideration it was concluded that if the usual unsightly four-pin or six-pin cross-arm could be done away with a still greater advantage would be secured. The question of short poles was an interesting one, for it was felt that if the short pole could be used it would have the twofold effect of decreasing the cost of the construction very materially and also improving the appearance of the distribution system.

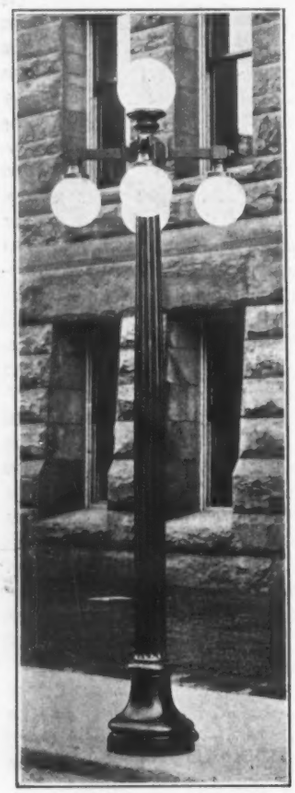


Fig. 2—Post Used in Business Section.

Up to this time no thought had been given in connection with the incandescent lighting for the residential section to any other than the usual series system of distribution. Upon investigation, however, it was found that by running 2200-volt feeders from the substations, employing the usual type of pole transformer to step down the primary pressure to 230 volts, and making a standard three-wire secondary distribution with multiple lamps, an exceedingly flexible system would result. This plan, in addition to being much cheaper than the series system, would have the advantage that the high-voltage lines could be concentrated on a few "feeder" streets, upon which, of course, high poles would be located. This arrangement coincided exactly with the proposed scheme for residence distribution, and its adoption enabled the system to have at least 80 per cent of its poles carry a maximum potential of only 115 volts to ground. The advantage of this was at once apparent. The wires did not need to be placed high, and there was no risk whatever in running such low-voltage lines through the trees on Toronto's streets.

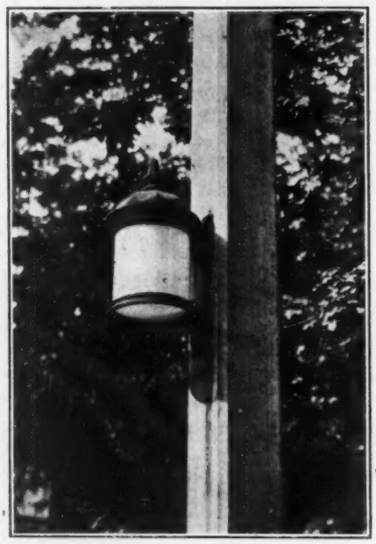


Fig. 3—Detail of Lantern Used in Residential Section.

It was felt that with the necessity for high poles eliminated one of the greatest difficulties was overcome, and the officials of the Toronto system set about getting quotations on Western cedar poles having a length not exceeding 25 ft. Unfortunately, the prices quoted on Western cedar poles of this size were disappointing, and although more success was had in connection with Michigan cedar, the prices were, nevertheless, altogether unsatisfactory. Attempts were also made to obtain quotations on octagonal poles, but no dealer could be found who could supply the number of poles desired.

For a considerable time the engineers of the Toronto Hydro-Electric System had discussed concrete poles, and when matters had reached a point where a short pole was feasible it was felt that a concrete type would not only present a very attractive appearance but could possibly be obtained at a reasonable cost, which, although higher than the cost of an equivalent wooden pole, would be justified by the superior lasting qualities. The investment in the long run would also be a better one. The prices quoted

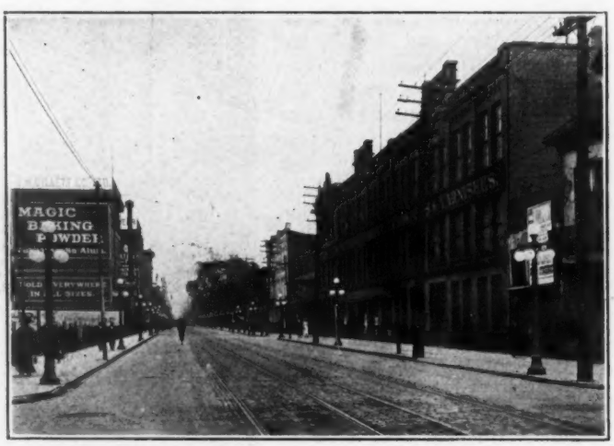


Fig. 4—Standards on King Street.

on concrete poles in 24-ft. sizes ranged at about $15 each at Toronto, and considering the fact that it was expected that some 30,000 would be required, the expenditure would have been serious. The municipality's engineers then determined to do some investigating on their own account, with results which were highly satisfactory. It is not

Fig. 5—Standard Concrete Post, Lantern and Wiring.

intended here to discuss either the concrete pole experiments or the municipality's subsequent experience in the manufacture of such poles, beyond a statement to the effect that a concrete pole was finally designed the cost of which approximated $5. This pole was adopted as the standard, and the Toronto system has now in use some 25,000 of them.

On the concrete pole, in place of using a cross-arm of the ordinary type, it was decided to hang the circuits vertically (the street-lighting wires on the street side of the pole and the residence wires on the property side), thereby doing away with one of the particularly unsightly features which characterize usual overhead work. The illustrations show very clearly the appearance of this construction, and in Fig. 6 it will be noticed that the upper parts of the poles, as well as the wires, are completely con-

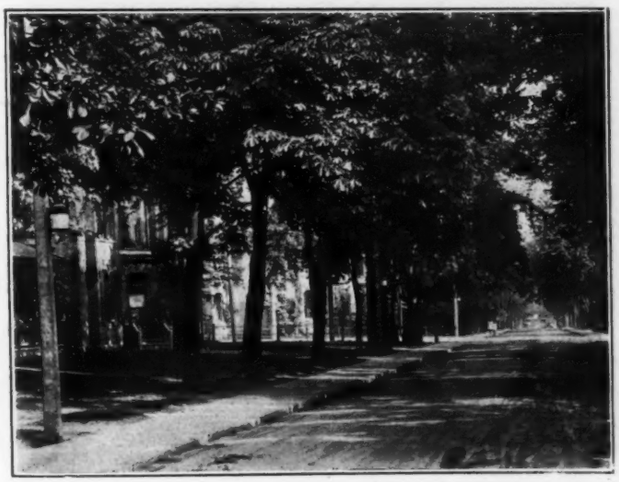


Fig. 6—Typical Installation on Heavily Shaded Street.

cealed from view. When the concrete pole was adopted all further thought of goosenecks, poke-bonnets and such devices was put out of our minds forever, and it was decided that whatever the fixture used it would have to fit close against the pole.

In giving consideration to the artistic appearance of the street lighting it was felt that with the use of incandescent lamps one of the vitally important things was to have them well aligned and all clearly visible; that is to say, when a person stood in the center of the street he would be able to see all the lamps on both sides for a very considerable distance. A height of 9 ft. 6 in. from the sidewalk to the center of the lamp was therefore adopted as being the distance which gave a fair distribution and yet would not be so high as to cause the lamp to be hidden by the trees.

In developing a satisfactory mounting for the lamp over fifty different designs were evolved. These designs were duly considered and the most promising ones were converted into full-size wood models, which were mounted upon concrete poles and were provided with glassware and lamps, the latter being operated by energy obtained from a nearby plant. As a result of this experimental work the fixture shown in the illustrations was finally adopted, and the writer is thoroughly satisfied that the lantern is inex-

Fig. 7—Distribution Employed in Residential Section.

pensive, strong, easily opened for cleaning and for lamp renewing, and acceptable in appearance. The glassware consists of a cylinder of translucent glass with a closed bottom.

For a time there was some local criticism because clear-glass cylinders, were not used, but the softening of the light and the diffusion which is obtained entirely counteract the very small loss which occurs in this translucent glass as compared with clear glass. Clear-glass cylinders will, of course, permit a little more light on the street, but the observer will not be able to see as well, and this, in the writer's opinion, is the final test of any system of illumination.

In the central downtown districts five-lamp clusters spaced about 80 ft. apart are used, and eight of these clusters are placed at each street intersection. The design comprises a cast-iron fluted shaft with circular base, and was made up by our own men. In some of the uptown districts where the concrete-pole construction is used there are eight 100-watt lamps at street intersections, though in the majority of cases there are only four.

This important question of intersection lighting is one

upon which there has been considerable comment. In an arc-lighting system with lamps placed at the corners the street intersections are, of course, very highly illuminated, and between lamps there are long dark stretches. The Toronto incandescent system does away with this uneven distribution of light, with the result that when the system

Fig. 8—Night View of Street in Residential Section.

was first operated the street intersections seemed to disappear. Complaints on this point have largely diminished, however. Should any street intersection require something beyond the standard lighting, the substitution of a larger lamp at once solves the difficulty, though any change of this nature is hardly necessary.

In connection with the placing of the concrete poles it was thought at first that a better distribution of light would result if the poles were staggered instead of being placed opposite each other. Poles were therefore set up on one street 100 ft. apart on one side and 50 ft. apart on the other side, with wiring and switches so arranged that it was an easy matter to throw the lamps into any combination desired. Certainly, with the lamps staggered there was a better distribution, but not enough better to overcome the objections to the staggered system. With the lamps opposite each other bands of light are cast across the roadway and it was found from experience that this series of bright bands makes it easier to see an approaching vehicle. Furthermore, poles were placed opposite each other to facilitate cross-guying for the purpose of relieving the side pulls occasioned by service wires leading to residences, and maintaining more perfect alignment.

When the downtown and uptown plans were thoroughly developed a test installation of each kind was made. In the downtown district the necessary energy was obtained from a nearby private plant, and for the uptown installation a storage battery was brought to the location every night on a truck. It may be said with all truthfulness that the citizens of Toronto were highly enthusiastic over both these demonstrations, and the City Council at once asked for data on the annual cost. A recommendation was submitted by the electric department calling for five-lamp clusters in the downtown districts, placed approximately 80 ft. apart, and single-unit 100-watt lanterns for the residence districts, placed 100 ft. apart. It was estimated that the five-lamp clusters could be installed at a cost to the city of $52.50 each per annum, and that the single 100-watt lamps would cost $9 each per annum. These figures are inclusive of all charges, such as energy, lamp and glassware renewals, cleaning, general maintenance, depreciation, interest, sinking fund, and so forth. The City Council approved this recommendation and gave instructions to proceed with the installation, and the department has been busily engaged ever since.

At the present time there are in operation about 450 of the five-lamp clusters in addition to 32,000 single units. The lamps are mounted on spring suspensions so that no breakage from vibration has been experienced. The average lamp life ranges from 1500 to 1800 hours. The system is not yet completed, and before the end of the year there will be 35,000 single units in commission. Owing to the termination of the old street-lighting contract and the limited time in which the work had to be accomplished, single units were first placed on one side of the street only. So far quite a number of streets have lamps on both sides, but the great majority have lighting on one side only. The distribution consists of fifteen 2200-volt circuits switched from the substations. The primary lines are run on parallel streets approximately 3000 ft. apart. The secondary lines fed from these cover the intermediate streets.

Without exaggeration it can be said that the city of Toronto is to-day—despite a partially completed system—the best-lighted city on the American continent. There are plenty of cities with small sections better lighted—and by that is meant quantity of light, not quality—but the point which is made in placing Toronto at the head of the list is that while no portion of the city is excessively lighted, on the other hand there is no portion which has not been given practically perfect lighting. Toronto is further unique in being the only large city in which tungsten lamps are used exclusively for street lighting.

The writer frequently has occasion to visit various American cities such as Detroit, Toledo, Cleveland, Buffalo, Rochester, Albany, Springfield, Boston and New York, and the more he sees of the arc lighting in these cities the more thoroughly convinced he is of the superiority of the incandescent lamp for street illumination.

KEOKUK-ST. LOUIS TRANSMISSION LINE.

Description of the Chief Preliminary Construction Features.

Following an urgent need, long-distance transmission of electrical power has developed in recent years more rapidly perhaps than any other branch of electrical industry. No novelty attaches to covering 100 miles, and three times this distance has been found quite within the range of practical

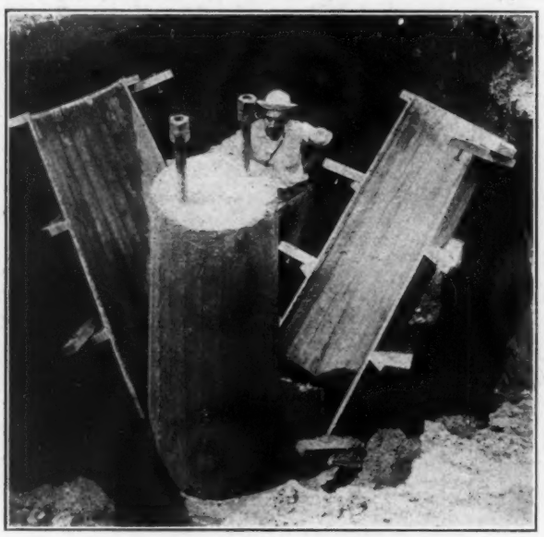


Fig. 1—Foundation for Anchor Tower.

electrical engineering when modern needs have demanded.

In fact, the interesting and difficult problems now fall quite as frequently on the mechanical as on the electrical side. Many of the earlier transmission systems were located in high altitudes and involved special electrical problems. With the increasing number of large systems in the low-

lying country, engineering skill has been drawn more and more to questions of mechanical tension, support and anchorage connected with long, heavy spans.

The Keokuk-St. Louis transmission line involves, as a whole, what is said to be the heaviest work of the kind that has yet been undertaken. It is designed to transmit 90,000 hp over two three-phase lines. The six transmission cables are of stranded copper, 7/8 in. in diameter, and consequently are quite heavy. There is also a steel ground cable. The standard towers are built to support a load, allowing for all weather conditions, of more than 9000 lb. each, on the usual spacing adopted of 800 ft. Furthermore, the heavy cables are lifted across the wide expanses of the Mississippi River and the Missouri River altogether three times in traversing the 140 miles from Keokuk to St. Louis. From the roof of the power house at Keokuk, on the Iowa side of the Mississippi, the lines swing over into Illinois. They continue in a southerly direction about 110 miles, measured in an air line, to Brussels, where the Mississippi makes a wide semi-circular sweep to the eastward across the right-of-way, necessitating a second crossing. Before another 7 miles is traversed on the route southeast into St. Louis the Missouri River is encountered, and, as though to substantiate the claims that it is really the parent stream, it demands one span of 3200 ft.—greater than any in the previous crossings of the Mississippi—and a second span almost as long. It requires also, on an island at the mid-point of the crossing, one of the highest transmission towers, if not the highest, yet erected.

Lifting the lines to a height of 220 ft., this tower enables them, despite the long span and consequent heavy deflection, to clear the river channel at a minimum height of 70 ft.

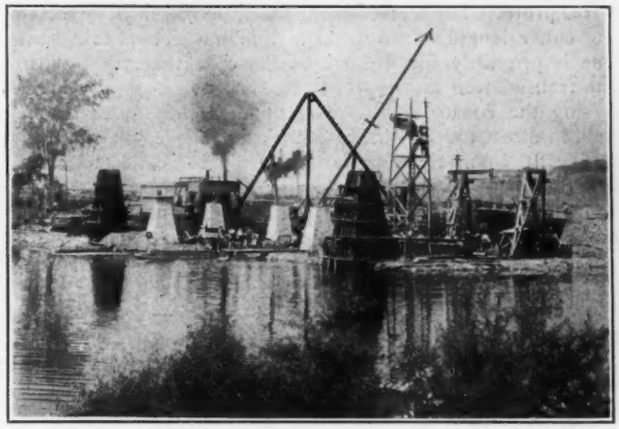


Fig. 2—Pedestals for Tower, Crossing the Mississippi.

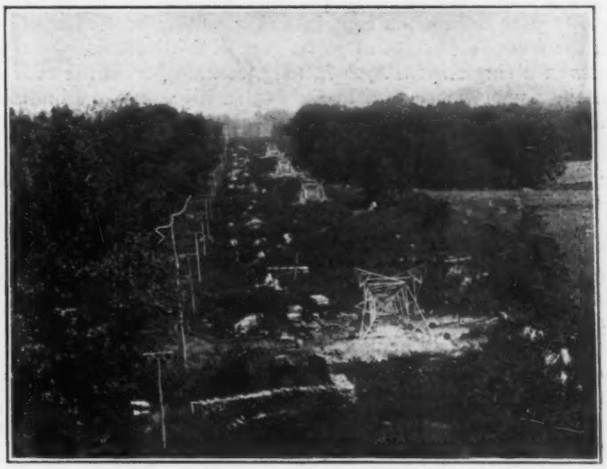


Fig. 4—Towers Assembled Ready for Erection.

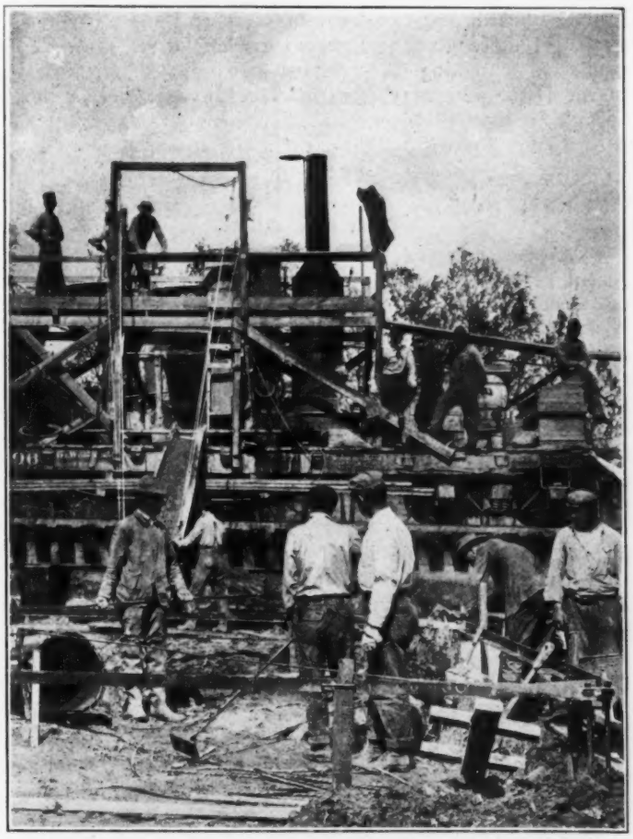


Fig. 3—Putting in Tower Foundation with Construction Train.

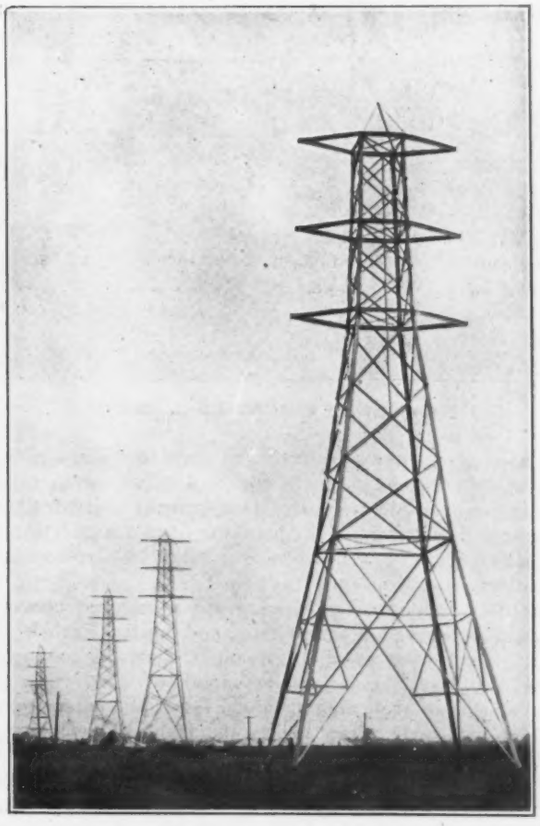


Fig. 5—Line of Standard Towers.

The tower on the south bank is 180 ft. high, being located on higher ground. On the north bank the line descends to an anchor tower 50 ft. high, where it is dead-ended. The lines are dead-ended by means of these low-anchor towers also at the Brussels crossing of the Mississippi River.

At the Brussels crossing the lines are carried on towers 150 ft. high, located on islands, and clear the three channels of the river at a height of 70 ft. The Keokuk crossing consists of a single span, 2900 ft. long, reaching from the roof of the power house to a tower 135 ft. high on the Illinois side. A type of cable, made particularly for this purpose, is used on the several crossings. It is known as special river-crossing cable and has a plow steel core, enabling it to withstand a working tension of 24,000 lb. per cable.

The right-of-way for the transmission line across the country is 100 ft. wide. The initial installation consists of one double-circuit tower line, with towers spaced approximately 800 ft. apart on level country, the spans varying from 400 ft. to 1600 ft. over the rougher country. Two types of towers will be used, known as standard and anchor towers. Every seventh tower, the interval averaging about a mile, will be an anchor tower, and anchor towers will be

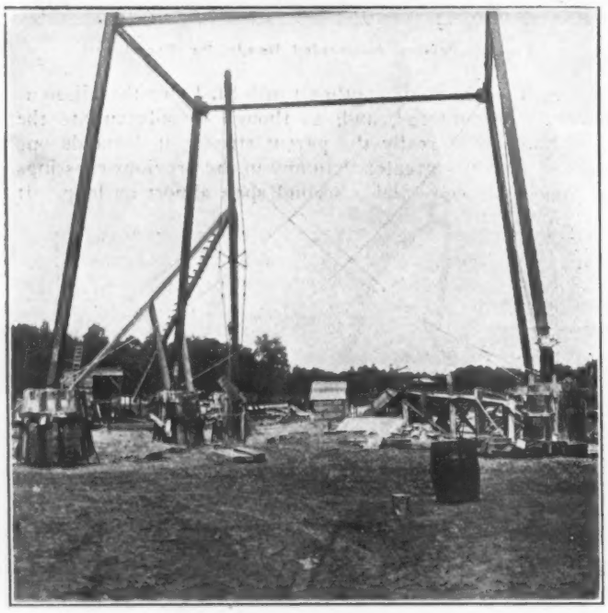


Fig. 6—Erecting Steel for 220-ft. Tower.

used at every change of direction of the line. These anchor towers are designed to carry the load of all seven cables breaking on one side, while the standard towers are designed to withstand the strain of the breaking of two conductors on one side of the tower. For durability the towers are galvanized.

The foundations of all towers are reinforced concrete designed to resist both compression and uplift. Each leg of the standard towers will rest on a pedestal having a diameter of 5 ft. at a minimum depth of 5 ft. from the surface, with a truncated cone of lesser diameter superimposed and rising a few inches above the surface to step the foot of the tower.

The two circuits will be carried on suspension insulators, the cables of each circuit being arranged in a vertical plane spaced 10 ft. apart, with a minimum clearance of 50 ft. between the lower cable and the ground at the tower and 30 ft. at the center.

The main conductors have a cross-section of 300,000 circ. mils and consist of nineteen-strand copper cable. The ground cable is strung on the top of the towers and consists of seven-strand Siemens-Martin galvanized-steel cable.

The insulators consist of seven 10-in. disks of the suspension type on the standard towers, and a specially designed type of strain insulator is used on the dead-end or anchor towers. Each of these latter insulators consists of two strings of eight 10-in. disks, yoked together in parallel. The mechanical strength of these yoked insulators is 20,000 lb.

An independent telephone line consisting of two copper wires protected by a steel ground wire has been constructed the entire length of the transmission line. This telephone line is primarily for the use of the operating force when the transmission line is in service, but it is very necessary during the construction period to keep the forces in the field in direct touch with the main office at Keokuk.

The St. Louis-Keokuk transmission line is the precursor of a transmission system which will be enlarged to take in various other cities as load conditions warrant. The Stone & Webster Engineering Corporation has charge of the work.

INSTALLATION OF SMALL POWER PLANTS IN FEDERAL OFFICE BUILDINGS—II.

By D. F. Atkins and H. M. Price.

IN the previous article on this subject the considerations governing the Treasury Department in the choice of the mechanical equipment of a federal building were outlined. The general arrangement of the apparatus and the rules governing the size and number of generating units were also treated at some length in order that the general practice of the Treasury Department might be understood. Having thus disposed of the vital points leading up to the choice of the engines and generators best adapted for the conditions obtaining, the present article will discuss the merits of the various types of machines, having in view the special needs of the department. The matter, however, is of general interest to the profession inasmuch as the Treasury Department requires the best that the market affords.

TYPE OF ENGINES.

By reason of the advancement in steam engineering in recent years a number of types of steam engines suitable for operating electric generators are available, each type possessing some merit peculiar to itself which adapts it to fill to best advantage certain operating conditions.

The simple and compound high-speed single-valve and simple and compound medium-speed Corliss-valve engines are the principal types offered. These engines are inclosed, self-oiling and equipped with automatic shaft governor and built either horizontal or vertical.

No arbitrary rules can be laid down to determine the choice of the proper type of engine, and each particular installation requires individual consideration. Floor space, size of unit, cost of coal, characteristics of load, steam pressures, building heating requirements and initial cost of installation are the principal factors which govern such selection.

SIMPLE SINGLE-VALVE ENGINE.

This type has the fewest mechanical parts of all of the types mentioned, which commends it in all cases where a minimum of attention is desired and attendants of only average ability are employed. It is also the least expensive, which further commends it where first cost is a factor. On the ground of relatively smaller investment it is usually selected for small units up to 50-kw loads. This type is also recommended in somewhat larger sizes where coal is not expensive (say $2 or less per ton) and for installations where the unit is in service for but short periods. It is also well adapted for use in buildings which must be heated during a large part of the year or where the demand for steam heating exceeds the engine exhaust.

The speeds of this type of engine range as follows:

SPEEDS OF SIMPLE SINGLE-VALVE ENGINES.

Kilowatt Rating.	Revolutions per Minute.	Kilowatt Rating.	Revolutions per Minute.
25	300–450	125	225–275
35	300–350	150	200–260
50	275–325	200	150–225
75	250–325	250	150–220
100	250–300	300	150–200

The steam consumption per indicated horse-power per hour for all the different sizes given above should not exceed the following amounts when operating with atmospheric exhaust and at the initial steam pressures stated:

STEAM CONSUMPTION PER INDICATED HORSE-POWER PER HOUR OF SIMPLE SINGLE-VALVE ENGINES.

Initial Steam Pressure, Lb.	One-quarter Load, Lb.	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
80	48.9	37.8	34.3	33.8	34.3
90	44.0	35.4	32.4	32.0	32.5
100	40.5	33.4	30.9	30.6	31.1
110	37.6	31.7	29.6	29.2	29.7
120	35.3	30.2	28.5	28.1	28.4
130	33.9	29.0	27.6	27.2	27.7
140	32.5	28.1	26.2	26.3	26.9
150	31.6	27.1	25.8	25.6	26.1

The mechanical efficiency of engines of this type is usually not less than 95 per cent for engines under 300 hp in rating and 94 per cent for larger sizes.

SIMPLE CORLISS-VALVE ENGINE

This type is a development of the releasing Corliss valve gear engine and partakes of its characteristics so far as steam consumption is concerned. By reason of fewer parts, without auxiliary cut-offs, dash-pots, etc., more advantageous regulation and speeds are obtainable, making it admirably suited for installation in federal buildings, where the available floor space is usually limited. It is recommended for units 75 kw in size and above, for localities where coal costs over $2 per ton, and with steam pressures in general use which range from 110 lb. to 125 lb.

The steam-consumption curve of engines of this type is very flat throughout its range, which adapts it for installations with fluctuating loads. This, combined with the high mechanical efficiency, commends this type for the usual federal building installation.

Corliss-valve engine speeds are about as follows:

SPEEDS OF CORLISS-VALVE ENGINES.

Kilowatt Rating.	Revolutions per Minute.	Kilowatt Rating.	Revolutions per Minute.
75	225–250	200	150–200
100	225–250	250	150–200
125	200–225	300	150–200
150	220–225		

Steam per indicated horse-power per hour required by engines of this type when operating at the initial steam pressures indicated and with atmospheric exhaust should not exceed the following amounts for any of the sizes above noted:

STEAM CONSUMPTION OF CORLISS-VALVE ENGINES.

Initial Steam Pressure, Lb.	One-quarter Load, Lb.	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
80	40.0	29.6	27.4	27.5	28.8
90	37.0	27.8	26.1	26.4	27.5
100	34.8	26.4	24.8	25.3	26.4
110	33.3	25.3	23.8	24.3	25.3
120	32.4	24.5	23.1	23.6	24.7
130	31.8	24.0	22.6	23.0	24.2
140	31.2	23.6	22.2	22.6	23.8
150	30.4	23.1	21.8	22.3	23.5

The mechanical efficiency of simple Corliss-valve engines is usually not less than 94 per cent for engines under 300 hp and 93 per cent for larger sizes.

COMPOUND SINGLE-VALVE ENGINE.

This engine is adapted for installations having comparatively high steam pressures, ranging upward from 120 lb. with no back pressure, or else operating condensing. As shown by the table of steam consumption following, compound engines are not economical at light loads, and therefore constant full loads are necessary for best results.

The speeds of this type, built either tandem or cross-compound, are about the same as those given for the simple single-valve engines.

The steam consumption per indicated horse-power per hour for engines ranging from 75 kw to 300 kw should not exceed the amounts given in the following table when operating at the initial steam pressures given and with atmospheric exhaust:

STEAM CONSUMPTION OF COMPOUND SINGLE-VALVE ENGINES.

Initial Steam Pressure, Lb.	One-quarter Load, Lb.	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
100	48.6	32.9	28.2	27.5	28.0
110	44.6	29.5	25.4	24.6	25.0
120	42.4	28.2	24.3	23.5	24.0
130	41.3	27.6	23.7	23.0	23.4
140	40.3	27.0	23.2	22.5	22.9
150	39.4	26.5	22.7	22.0	22.4
160	38.7	26.0	22.2	21.5	21.9
170	38.3	25.6	21.8	21.1	21.6

The amounts given in the preceding table are bettered approximately 15 per cent for the quarter and half loads and 20 per cent for the other loads when operating condensing with about 24 in. of vacuum. The amount of steam required for the condenser, when condensing water is available, will average 7 per cent of the steam used by the engine, leaving a net gain of about 8 per cent for light loads and 13 per cent for heavier loads when operating condensing instead of with atmospheric exhaust.

For engines of this type of less than 300 hp capacity the mechanical efficiency is about 93 per cent and in larger sizes about 92 per cent.

COMPOUND CORLISS-VALVE ENGINE.

This type of engine is recommended where proper operating conditions prevail and extreme economy is desired. These conditions are steam pressures of 120 lb. or higher, comparatively steady full load and exhausting with little or no back pressure, or operating condensing.

The speeds at which engines of this type operate are about the same as those given for simple Corliss-valve engines.

The engines of this type ranging in size from 75 kw to

300 kw, when operating at the initial steam pressures given and with atmospheric exhaust, should not consume at varying loads more than the amounts per indicated horse-power per hour following:

STEAM CONSUMPTION OF COMPOUND CORLISS-VALVE ENGINES.

Initial Steam Pressure, Lb.	One-quarter Load, Lb.	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
100	47.0	32.3	26.7	25.2	24.9
110	43.4	30.0	24.3	22.6	22.7
120	41.2	28.0	22.5	21.1	21.3
130	39.6	26.8	21.3	19.8	20.3
140	39.0	26.4	20.9	19.4	19.9
150	38.5	26.0	20.5	19.0	19.5
160	38.0	25.5	20.1	18.7	19.1
170	37.6	25.0	19.8	18.4	18.8

The amounts given in the table above are improved about the same percentage when operating condensing as given under compound single-valve engines preceding.

The mechanical efficiency of compound Corliss-valve engines of less than 300 hp capacity is usually not less than 92 per cent and for larger sizes 91 per cent.

SELECTING AN ENGINE.

To show the utility of the foregoing data, the following example is given of determining the proper engine to be selected under assumed conditions of operation:

The engine is to be required to drive a 100-kw generator with 110-lb. initial steam pressure, exhausting at atmospheric pressure; loads ranging between half load and full load and a quarter; unit operating ten hours per day, 300 days per year, with coal costing $3.50 per ton.

With a simple single-valve type the steam consumption for varying loads taken from the table is as follows:

	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
Steam consumption per indicated hp per hour	31.7	29.6	29.2	29.7

The steam required per hour at varying loads would be as follows:

Half load	=31.7 lb. × 75	indicated hp = 2375 lb.
Three-quarters load	=29.6 lb. × 112.5	indicated hp = 3340 lb.
Full load	=29.2 lb. × 150	indicated hp = 4370 lb.
One and a quarter load	=29.7 lb. × 187.5	indicated hp = 5575 lb.
Average steam per hour (13,660 lb. ÷ 4)		= 3915 lb.
Yearly steam consumption of engine (3915 × 3000)		= 11,745,000 lb.

With the simple Corliss-valve engine operating the same as above, with steam consumption taken from the table, steam required per hour would be in accordance with the following:

	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
Steam consumption per indicated hp per hour	25.3	23.8	24.3	25.3

Half load	=25.3 lb. × 75	indicated hp = 1900 lb.
Three-quarters load	=23.8 lb. × 112.5	indicated hp = 2680 lb.
Full load	=24.3 lb. × 150	indicated hp = 3650 lb.
One and a quarter load	=25.3 lb. × 187.5	indicated hp = 4810 lb.
Average steam per hour (13,040 lb. ÷ 4)		= 3260 lb.
Yearly steam consumption of engine (3260 × 3000)		= 9,780,000 lb.

A compound single-valve engine operating under the same conditions will for varying loads require the following amount of steam:

	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
Steam consumption per indicated hp per hour	29.5	25.4	24.6	25.0

Half load	=29.5 lb. × 75	indicated hp = 2210 lb.
Three-quarters load	=25.4 lb. × 112.5	indicated hp = 2860 lb.
Full load	=24.6 lb. × 150	indicated hp = 3680 lb.
One and a quarter load	=25.0 lb. × 187.5	indicated hp = 4730 lb.
Average steam per hour (13,480 lb. ÷ 4)		= 3370 lb.
Yearly steam consumption of engine (3370 × 3000)		= 10,110,000 lb.

With a compound Corliss-valve engine the steam required at varying loads will be as follows:

	One-half Load, Lb.	Three-quarters Load, Lb.	Full Load, Lb.	One and a Quarter Load, Lb.
Steam consumption per indicated hp per hour	30.0	24.3	22.6	22.7

Half load	=30.0 lb. × 75	indicated hp = 2250 lb.
Three-quarters load	=24.3 lb. × 112.5	indicated hp = 2740 lb.
Full load	=22.6 lb. × 150	indicated hp = 3380 lb.
One and a quarter load	=22.7 lb. × 187.5	indicated hp = 4290 lb.
Average steam per hour (12,660 lb. ÷ 4)		= 3165 lb.
Yearly steam consumption of engine (3165 × 3000)		= 9,495,000 lb.

Comparing the performance of the simple single-valve engine with the simple Corliss-valve engine, there will be the difference between 11,745,000 lb. steam and 9,780,000 lb., or 1,965,000 lb. steam less required for the simple Corliss-valve than for the simple single-valve engine. Reducing this saving in steam to coal at 8-lb. evaporation, there is a total saving of 245,625 lb. of coal, or about 109 tons of 2240 lb. each. This saving in coal at $3.50 a ton amounts to approximately $381 per annum, which would justify the difference in the amount of investment in the two engines, roughly about $1,200.

While the compound single-valve engine shows a gain over the simple single-valve engine, it is obviously insufficient to weigh against the selection of the simple Corliss-valve type; and as the compound Corliss-valve engine, in comparison with the simple Corliss-valve type, does not show enough gain to warrant selection at its greatly increased price, it may be concluded that the simple Corliss-valve engine would be the proper one to choose.

If the coal in the above example had been purchased for $1.50 per ton, the yearly saving with the simple Corliss-valve engine over the simple single-valve engine would have been only $163, an amount insufficient to justify the expenditure of the additional sum necessary to purchase the simple Corliss-valve engine.

The engine efficiencies have been ignored in the above calculations, as the only object was to show the use of the tables and the method of calculating the steam required per indicated horse-power with different type machines.

ELECTRIC GENERATORS.

The usual load consists of elevators, lighting, ventilating fans and pumps, the elevator load being the major part of the total load. It is therefore desirable to use a generator of such characteristics that a fairly constant lighting voltage will be maintained when the elevators are thrown on the circuit and frequent overloads will be carried without sparking. These characteristics are best obtained in the interpole design.

In a non-interpole generator sparking is due primarily

to a local magnetic field surrounding a coil which is being commutated. This field sets up a counter emf, or voltage, in the commutated coil in such a way as to oppose the reversal of the current in the coil, and thus tends to cause sparking as the coil of commutator bar leaves the brush. This action increases with current or load, and is especially destructive at heavy overloads.

In a non-interpole machine sparkless commutation may be obtained if the brushes can be so located that the armature coils short-circuited by them are brought into a magnetic field of exactly the right direction and strength to neutralize the effect of the local field at the moment of commutation.

Such a field is found to exist near the tips of the pole pieces, and it has been customary to advance the generator brushes sufficiently to bring the armature coils within it during commutation; but this field varies in strength under various conditions of loads, and instead of becoming stronger with increase of loads, it actually becomes weaker.

In interpole generators the proper conditions for commutation are obtained by the use of small poles interspaced between the main poles. The interpoles have their windings in series with the armature and set up magnetic fields which annul the effect of the fields formed by armature magnetization and generate in the commutated coils an emf which assists the reversal of the current. Since the interpole coils are in series with the armature, the interpole field strength varies in proportion to the load, and it thus has the proper corrective effect at all loads.

Since the emf due to the interpole which assists reversal has a definite position under the interpole, the coil being reversed must also be located accurately with respect to this reversing emf. The brushes are consequently located on the true neutral point, and experience proves that sparkless commutation can be obtained under practically all conditions from no-load to very heavy overloads.

COMMERCIAL KILOWATT AND SPEED RATINGS OF DIRECT-CURRENT GENERATORS.

Standard commercial speeds and kilowatt capacities from 25 kw to 300 kw for 125-volt, 250-volt and 125-250-volt, three-wire generators are as follows for interpole machinery:

Kilowatt Rating.	Revolutions per Minute.	Kilowatt Rating.	Revolutions per Minute.
25	295–305–310–325	125	225–250–260–275
35	285–305–315	150	200–220–250–260–275
50	275–280–290–300	200	100–150–200–210–220
75	250–265–275–290	250	150–200–220
100	250–260–275	300	100–120–150–200–220

Late designs are provided with steel frames to produce rugged construction and at the same time to reduce the handling and shipping weights and permit light foundations. The later types of machines have open-end windings on the armatures as well as air ducts in the armature cores for ventilation. The shunt-field coils are form-wound in comparatively long coils of small radial depth. The series and interpole coils are wound from bare copper strap insulated with spacers, with ample air ducts between the poles, shunt coils and series coils, so that the armature and field windings of the generator are open to free ventilation.

Based on a room temperature of 25 deg. C., the temperature rise at full load should not exceed 35 deg. C. after continuous operation nor 50 deg. C. after two hours' operation at 25 per cent overload. A small margin should be allowed, say 5 deg. C., on the commutators of 125-volt generators.

In another issue will be given a specification for engines and generators as prepared in the office of the supervising architect of the Treasury Department.

REPLACING OLD TRANSFORMER CORES WITH NEW ONES.

By JOHN G. HOMAN.

RECENTLY a large and progressive lighting concern has gone into the matter of replacing the cores of its older transformers with new ones of improved material. In the light of recent advances in the manufacture of silicon-iron alloys this procedure seems worthy of consideration. The concern mentioned has already used many tons of new steel in the replacement of old cores.

Below are given the results of an investigation of the possible economy resulting from the change of cores in a representative line of 1906 transformers of the type intended for lighting loads. Fig. 1 shows the core and copper losses as functions of output rating, or size, of the transformers to be considered for new cores. Unless very considerable aging has taken place in the transformer cores, it is doubtful whether apparatus of manufacture more recent than 1906 would show any economy by the change.

As the change is supposed to result in much lower core losses, the first thing to know is the quality of steel in the old cores and its comparison with the available higher quality silicon-iron alloy. In Fig. No. 2 curve *a* shows the character of the material used for transformer cores in 1906, while curve *b* gives a fair criterion for material to be had at present. The curves show total core or iron loss (the sum of eddy current and hysteresis losses) in watts per pound of material, as a function of the magnetic density

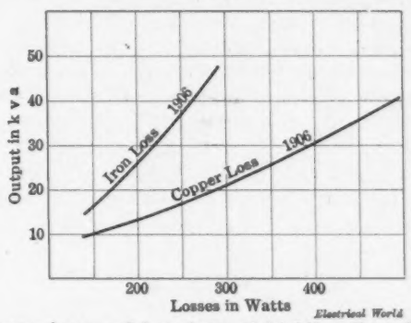


Fig. 1—Copper Loss and Iron Loss of Lighting Transformers Six Years Old.

measured in lines per square centimeter at 60 cycles with a sine wave of time value.

The new material is approximately 45 per cent better than the old at any practical density of magnetism.

As an example suppose the core of a 20-kva transformer be changed. The old one, according to Fig. 1, has a core loss of 170 watts; the new core is 45 per cent better, so that it should have a total core loss of 93 watts. The difference is 674 kw-hr. per year.

The approximate price of silicon-iron transformer material having the quality indicated by curve *b* in Fig. 2 is 6 cents per pound at Pittsburgh. The size is No. 29 United States standard gage, which corresponds to a thickness of about 0.014 in. Since the core laminas of nearly all core-type apparatus, and of shell-type also, are of simple form bounded by straight lines and convex angles, it follows that these core laminas may be easily and accurately cut from the sheet by means of the ordinary tinner's squaring shears. The loss of material as scrap need not exceed 5 per cent.

The core of the 20-kva transformer in argument should not exceed 200 lb. in weight, so that the material ready for the new core would cost $12.60 plus the freight. The matter of building up the new core is very simple, and after a few cores have been changed the workmen will become more or less expert in the operation. It seems fair to estimate that the labor cost need not exceed the cost of material. In round numbers, then, the replaced core may be said to cost $26. The saving per year of 674 kw-hr. at 1 cent per

kw-hr. is a saving of $6.74, or an income on the investment exceeding 25 per cent per annum.

In the repaired transformer the total full-load losses to be dissipated amount to 380 watts as against its original 457 watts. In Fig. No. 4 the efficiencies of the transformer at various loads are shown by curves. Curve *a* is for the unrepaired apparatus, while curve *b* is for the repaired. These curves show that at a load of 25 kva, which is 125 per cent of the transformer's original load rating, the efficiency of the repaired apparatus is higher than the very highest figure for the unrepaired transformer.

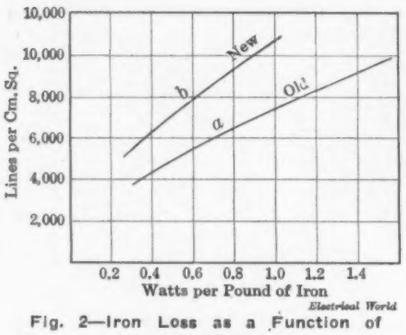


Fig. 2—Iron Loss as a Function of Magnetic Density.

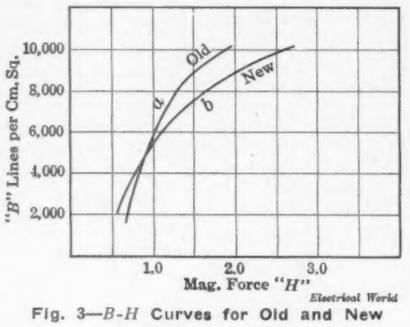


Fig. 3—*B-H* Curves for Old and New Transformer Steel.

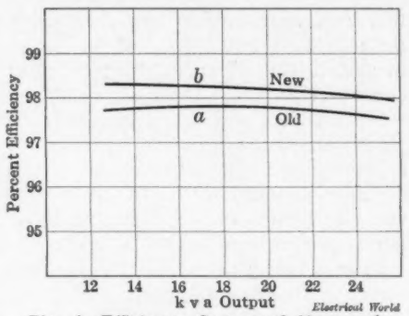


Fig. 4—Efficiency Curves of New and Old Cores of 20-kva Transformer.

If it is desired to increase the output of the repaired transformer, more coil radiation may be provided by making the new core enough smaller to allow for oil circulation between it and the coils. Strips of wood may be used as separators. In the smaller transformers it is doubtful whether this procedure is necessary for overloads not exceeding 25 per cent.

Besides the saving of 674 kw-hr. per year, there is also the asset of increased output. How valuable this increase is depends upon the value of regulation. If a regulation of 2 per cent is tolerable, a carrying capacity of 22 kva or more may be easily had. At present transformer prices this extra 2 kva is worth close to $15. This, then, is an extra advantage.

The above estimations are based on transformers the cores of which are not subject to aging. Quite recently there was brought to the writer's attention a core loss test which displayed an aging effect of more than 100 per cent, the core loss increase having taken place in seven years. It is fair to believe that most transformers manufactured prior to 1904 have aged, and, taking mixed brands of this date and earlier throughout a distributing system, an increase of 15 per cent would be a safe approximation for their present losses.

Silicon-iron alloy does not increase in core losses with age. The probability of correcting an aged core is then another advantage not considered above.

Those familiar with the new steel may question the exciting current coincident with the new core. The answer is that in the earlier transformers the magnetic densities were comparatively low, but all-around economy has necessitated higher magnetic densities in the later designs. In Fig. No. 3 are given two *B-H* curves, *b* being for silicon-alloy and *a* for steel approximating that used in 1906. The data for these curves were obtained from samples submitted to the United States Bureau of Standards.

The repairing of the 20-kva transformer representative of the best manufacture at the beginning of 1906 results in the approximate saving of 674 kw-hr. per annum; if aging has taken place in the cores the saving may in extreme cases be double this. The repaired transformer is capable of increased output. The repairing operation permits an inspection of the insulation, etc., which may result in saving. The life of the transformer is increased.

The weight of core in a transformer varies approximately at the 0.75 power of its kva rating. Considering the losses to vary directly with the weight of core, it would seem that as the size increased the saving from new cores would be less. However, the kw-hr. saved per pound of iron in any transformer is about the same. The labor cost of core replacement should decrease materially with transformer size increase. The labor on a 40-kva change should be very little more than for a 20-kva. So that while the saving in kilowatt-hours per kva of rating decreases with increase of size, the cost of replacement decreases approximately in proportion and the relative economy for the various sizes is about the same.

Transformers of the type intended for industrial service make repaired ones with good lighting service characteristics because they usually have better regulation.

RADIANT EFFICIENCY OF THE CARBON ARC LAMP.

By William H. Damon and William J. Enders.

Since the energy within the visible portion of the spectrum represents only a small part of the total energy emitted by a hot body, it is a matter of much importance in problems of illumination to have accurate information regarding the relative intensities of the visible and invisible radiations from various sources, and it is the purpose of this article to discuss the radiant efficiency of the crater of the direct-current carbon arc. The radiant efficiency is considered to be the ratio of the energy of the visible spectrum lying between 0 μ to 0.76 μ to the total energy. As the boundaries of the region are loosely defined and the limiting wave-lengths somewhat arbitrarily chosen, a comparison of the radiant efficiencies obtained by different observers for the arc and other sources of light shows a wide variation. The different methods used also give discordant results due to various errors. Any change in the boundary between the infra-red and visible gives a large variation in the radiant efficiency, because of the rapid increase of energy with wave-length near 0.8 μ. H. P. Gage[1] in his work on the radiant efficiency of the arc screened off the infra-red at 0.68 μ, considering the visible to lie between 0.68 μ and 0.4 μ, while others have considered different limits. The visible spectrum should extend as far as the average eye can be affected, and 0.76 μ is a fair limit. The definition of radiant efficiency as given above, a purely physiological one,

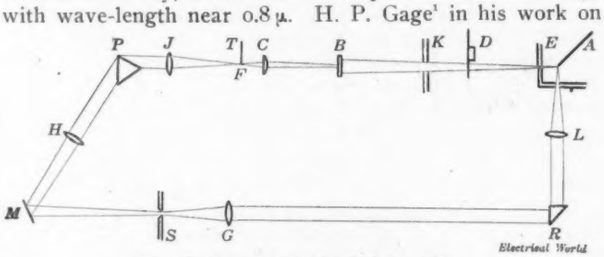


Fig. 1—Arrangement of Apparatus.

[1] *Physical Review*, Vol. 32, June, 1911.

loses its meaning when other limits are taken. In this work the infra-red rays were screened off at 0.76 μ, as this is generally accepted as the lower limit of the visible spectrum.

For this work the method adopted was that used by Mendenhall[2] in determining the luminous efficiency of the carbon filament and also by Forsythe.[3] It consists of a direct comparison of energy of two beams from the same source, from one of which all but the visible has been separated out. The Rubens thermopile, however, was replaced by a differential bolometer, thus making possible simultaneous measurements of the visible and total energies.

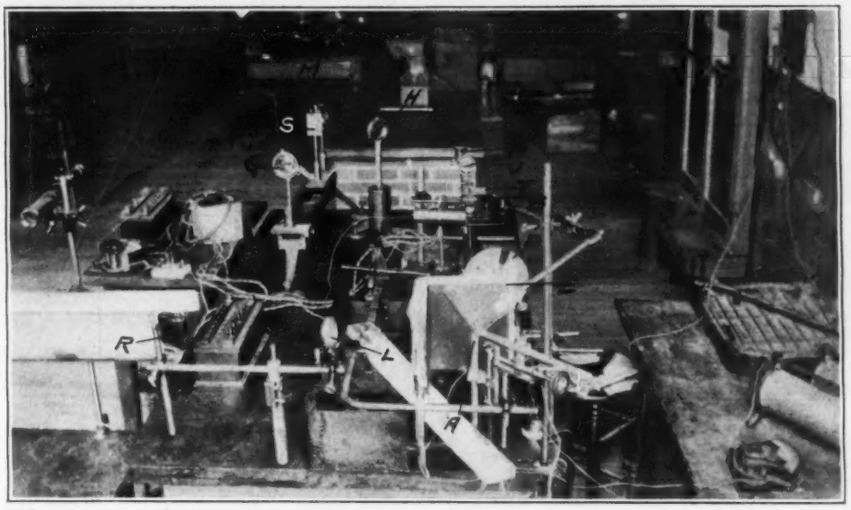


Fig. 2—Arrangement of Apparatus.

The arrangement of the apparatus is shown in Figs. 1 and 2, where *A* is the carbon arc the radiant efficiency of which is to be determined. The two carbon electrodes make an angle of 90 deg. with each other and are adjusted manually. The horizontal electrode which contains the positive crater makes an angle of 45 deg. with the other two beams as shown in Fig. 1. Rays from *A* pass through a 0.5-in. round hole in the screen *E*, are made parallel by the lens *L* and reflected by the prism *R* to the lens *G*, which brings them to a focus on the slit *S*. The rays diverge again and are reflected by the mirror *M* through the collimating lens *H* to the prism *P*, which is set to refract the light at the angle of minimum deviation. This prism separates the light into its different colors, while the lens *J* brings it to a focus at *F*, thus forming a spectrum in the plane of the screen *T* which can be adjusted to cut off the infra-red rays. *C* is a cylindrical lens which recombines the different colors so that the light falling upon the photometer or bolometer *B*, placed at the focus, is white. The other beam of light coming from *A* is partly cut out by the sectored disk *D*, passes through the screen *K* and strikes the photometer *B*.

The arc *A*, screen *E*, lens *L* and prism *R* were placed on one optical bench and could be moved horizontally in the direction of the beam of light from *A* to *B*. A photometric balance of the two beams was obtained at the bolometer by replacing it by a Lummer-Brodhun photometer and shifting the part *ALR* of the system back and forth as desired, cutting down the direct beam *AB* by a suitable sector *D*. It is evident, from Fig. 1, that the image of the light on *S* will not be changed in position or intensity by such a shift, because the rays are parallel from *R* to *G*.

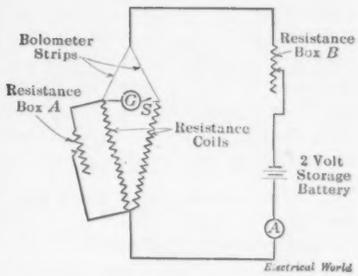


Fig. 3—Diagram of Connections.

The bolometer was made with a central disk of brass about 1/16 in. in thickness, having two lugs fastened to each side but insulated electrically from it with mica, the two upper lugs being soldered together. Platinum bolometer strips 0.5 mm wide connecting the upper and lower lugs were soldered in place. These two strips were selected so that each had practically the same resistance. After the strips were put in place their resistances were measured accurately by means of a Wheatstone bridge and found to be 3.51 ohms and 3.52 ohms respectively. Both platinum strips were blackened with camphor soot to increase their absorptive power so that they would absorb heat readily. The bolometer case was provided with three equally spaced partitions to cut down the effect of air currents on the bolometer strips.

Two resistance coils of No. 26 "advance" wire, each having a resistance of about 18 ohms, were wound non-inductively upon insulated brass cores and submerged in a bath of kerosene. The end of one coil was soldered to the end of the other and connected to a battery, while the

TABLE I.—RADIANT EFFICIENCIES FOR POSITIVE CRATER; VOLTS 60, AMPERES 7.5.

Company.	Electrode.	Deflections. Ea		Deflections. Ea+Eb		$\frac{Ea}{Eb}$		Observed Efficiency.	Corrected Efficiency.
National Carbon Co.	Columbia solid	20.03*R*	21.06*R*	7.08*L*	7.27*L*	1.38	1.378	14.50	14.73
National Carbon Co.	C. C. forced	17.42*R*	26.95*R*	.7*R*	2.51*R*	.98	.925	21.05	21.37
National Carbon Co.	Columbia cored	19.23*R*	18.51*R*	6.45*L*	5.81*L*	1.36	1.340	14.85	15.09
H. M. Hirschberg	Plania cored	22.43*R*	23.28*R*	7.45*L*	7.33*L*	1.358	1.340	14.87	15.10
H. M. Hirschberg	Plania solid	21.46*R*	23.78*R*	1.37*L*	1.18*L*	1.081	1.071	18.59	18.88
Central Elec. Co.	Siemens cored	7.85*R*	7.67*R*	2.62*L*	2.47*L*	1.345	1.340	14.89	15.12
Central Elec. Co.	Siemens solid	12.91*R*	13.58*R*	4.08*L*	4.40*L*	1.340	1.350	14.88	15.11
Western Elec. Co.	Blue Label cored	21.08*R*	17.56*R*	6.60*L*	5.71*L*	1.340	1.360	14.80	15.03
Western Elec. Co.	Blue Label solid	8.05*R*	8.58*R*	2.80*L*	2.91*L*	1.378	1.380	14.51	14.74
Western Elec. Co.	Pink Label cored	17.20*R*	20.82*R*	4.30*L*	4.80*L*	1.278	1.260	15.72	15.97
Western Elec. Co.	Pink Label solid	16.01*R*	10.60*R*	3.15*L*	1.76*L*	1.208	1.200	16.60	16.87

Ea+*Eb*=deflection with radiation falling on both sides of bolometer.
R=deflections to right. *L*=deflections to left.
One-half sector used for photometric balance. One-tenth sector used to cut down direct radiation.

[2]*Physical Review*, Vol. 20, March, 1905.
[3]*Physical Review*, Vol. 34, June, 1912.

other two ends were soldered to the lower lugs of the bolometer as shown in Fig. 3. If both sides of the bolometer were exactly alike and the two coils of the same resistance, the galvanometer would not deflect when the switch S is closed, provided that the energies falling on each side of the bolometer are equal. If the energies are not equal, one of the bolometer strips will heat up more than the other in proportion to the energy received. Since, for small ranges, the resistance of the strips varies lineally with the temperature and the temperature change is proportional to the energy received, the deflections of the galvanometer are proportional to the excess of the energy falling upon one of the strips. It is practically impossible to construct a bolometer with strips exactly alike. Although the bolometer was balanced when shielded from radiation, a small deflection was obtained when equal energies fell upon both sides. In order to know how these readings varied, a number of calibration curves were obtained using known sources of energy (Fig. 4). E_a is proportional to the energy falling upon the bolometer face toward C (Fig. 1) and E_b to that toward A. The bolometer current during calibration and in all subsequent readings was kept constant at 0.078 amp. The curves (Fig. 4) were straight lines passing through a common point on the x axis with a value of 1.022 for $\frac{E_a}{E_b}$. Then if the value E_a is known a straight line can be drawn through the point 1.022, and knowing the galvanometer reading when both sides of the bolometer are exposed the value of $\frac{E_a}{E_b}$ can be read directly.

By following through the various steps the method may be made clear. First, the screen T (Fig. 1) was set on the A line 0.76 μ by sending sunlight through the lens G, slit S and prism P and observing the lines of the spectrum through an eyepiece placed at C. This setting of the screen was checked before and after each series of readings. If the slit is too wide there will be an overlapping of the infra-red rays and a resulting efficiency of too high a value. Consequently, the slit was opened to a width of 0.5 mm, at

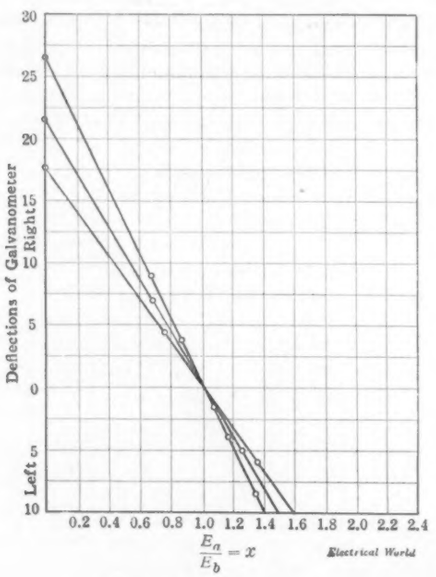


Fig. 4—Calibration Curves.

which position the principal Fraunhofer lines could still be seen, and it has been assumed that any error due to overlapping of the infra-red rays would then be negligible. A photometric balance was then obtained between the direct rays $A\,B$ (Fig. 1) and the indirect rays $A\,R\,S\,B$. A sectored disk was spun between the photometer and source to cut down the direct rays and a balance was obtained by moving the source on the optical bench. When a balance was obtained the bolometer was substituted for the photometer and readings were taken, first for the direct radiation, then for both direct and indirect at the same time.

Example: The direct reading for the Columbia solid carbon electrode was 20.03 cm to the right; for both direct and indirect, 7.08 cm to the left. From the calibration

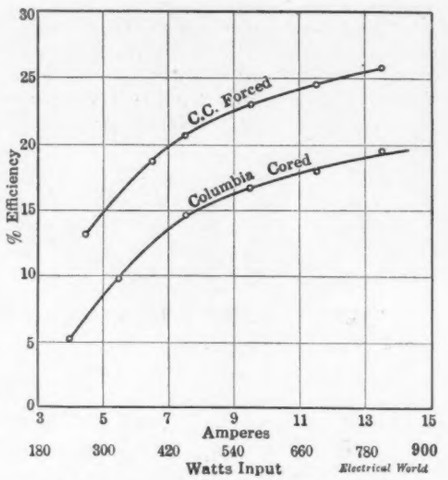


Fig. 5—Relations Between Radiant Efficiencies and Power and Current Input.

curves of the bolometer (Fig. 4) the value of the correction factor $x = \frac{E_a}{E_b}$ is 1.38 for a deflection of 20.03 cm to the right and 7.08 cm to the left. As a one-half disk was used between the source and photometer in obtaining a photometric balance and a one-tenth disk to cut down the direct rays when the readings were taken, the observed efficiency is equal to $\frac{10}{50} \times \frac{1}{1.38} \times 100 = 14.5$ per cent. A correction for the selective reflection of the mirror M (Fig. 1) has to be made, for which Ingersoll's value of 1.016 was used.[4] The correct efficiency is then $1.016 \times 14.5 = 14.73$ per cent. The results obtained for different electrodes are given in Table I.

In order to see the variation of radiant efficiency with a change of current, the efficiencies of two carbon electrodes, "C. C. forced" and "Columbia cored," were determined for several values of current. A constant voltage was maintained and the current varied by means of resistance in series with the arc. Table II gives the results obtained and Fig. 5 shows the radiant efficiencies ploted against watts and amperes input.

TABLE II.—TEST WITH VARIABLE CURRENT AT 60 VOLTS.

Electrode.	Amperes.	Watts.	Observed Efficiency.	Corrected Efficiency.
C. C. forced.....	4.5	270	12.83	13.03
	6.5	390	18.40	18.68
	7.5	450	20.40	20.73
	9.5	570	22.60	22.95
	11.5	690	24.00	24.40
	13.5	810	25.63	26.04
Columbia cored.....	3.9	234	5.05	5.14
	5.5	330	9.62	9.76
	7.5	450	14.28	14.45
	9.5	570	16.38	16.61
	11.5	690	17.54	17.82
	13.5	810	19.16	19.47

In measuring the radiant efficiency of the carbon arc, the principal difficulty encountered is the change in position of the crater. If it should shift toward the side of indirect

[4] *Physical Review*, Vol. 17, November, 1903.

radiation (toward lens *L*, Fig. I), the efficiency observed would be higher than if it remained in the center of the electrode or moved toward the opposite side. Moreover, a change in the shape of the crater causes a variation in the amount of light passing through the slit. In order to obtain a fair value several readings were taken and averaged.

The efficiencies of the different carbon electrodes for the same current (7.5 amp) and voltage (60 volts) range from 14.5 per cent to 21.61 per cent. Temperatures of the "C. C. forced carbon" and "Columbia cored" were measured and the temperature of the former was found to be higher than that of the latter, which fact probably explains the high efficiency of the former.

The authors wish to acknowledge their indebtedness to Profs. C. E. Mendenhall, E. M. Terry and W. E. Forsythe for suggestions and assistance in connection with this work.

EXPERIENCE WITH LIGNITE IN TEXAS CENTRAL STATIONS.

A large portion of the State of Texas is underlaid with lignite, or partially formed coal, which represents a fuel store of enormous value for the central-station plants of the Southwest. This lignite has been burned under boilers with a fair degree of success, but its value as fuel in bituminous gas producers is less conclusively proved. Practically all makers of gas-producer equipment have, after expensive experimentation, limited or withdrawn their recommendations for lignite gas-producer operation.

The use of lignite as a fuel was discussed at length at the recent Southwestern electrical convention at San Antonio, Tex., several operators pointing out the success already attained by them under their own special conditions of operation. Mr. E. W. Kellogg, El Paso, declared that while the ordinary run of mine-slack refuse coal, averaging 10,500 heat units per pound, gives a dense black smoke when burned on ordinary grates, the Coalgate product is practically smokeless, showing economies expressed in cents per kilowatt-hour very much higher than those obtained with even the highest grade of steaming coal. Mr. R. C. Brooks, Dallas, explained that lignite is usually not adapted for burning on automatic stokers, since it requires a stronger draft than that ordinarily afforded. While it produces more ash, it is nevertheless found to be a satisfactory fuel, and at $1.33 per ton, delivered, compares well with Oklahoma coal at $5 a ton. The Texas lignite has to be transported about 65 miles, and in even this distance suffers considerable reduction in size through slacking. Mr. W. S. Rathell, Waco, related the results of some comparative tests of lignite and oil made on a 150-hp boiler, six-hour periods being adopted. These tests showed 1 ton of McAlester slack to equal three barrels of fuel oil, while 1 ton of Rockdale lignite equaled 2.25 barrels of oil. Lignite-burning boilers have the disadvantage, added Mr. Rathell, that they cannot be forced. There is also an objectionable tendency to slacking of the lignite. As the result of all these drawbacks as developed from experience the local company found it necessary to carry auxiliary fuel, fearing to depend upon the lignite alone. A short time ago chain grates for burning lignite were installed, but without success. The slow ignition of the fuel made it impossible to keep up steam pressure. An excessive amount of labor was also required in removing ashes, etc. Even when protected from the weather by sheds and roofs lignite slacks and then ignites from spontaneous combustion.

Mr. A. E. Judge, of Tyler, reported that his company has been burning lignite with success for three years, having changed from oil when the latter reached $3 a barrel to lignite at $1.90 per ton, with an incident saving of about one-third of the fuel expense. At the outset lump lignite was used, but slack is now purchased at $1.40 per ton, about 10 per cent more being required to produce the equivalent heating effects of the large size. The fuel is burned under forced blast on a special Wilderspin grate having many ⅜-in. holes. The use of lignite has about doubled the cost of labor, said Mr. Judge, so that the net saving of lignite over oil represents the difference between $1,000 and $600 per month in operating expense. From every viewpoint, concluded the speaker, lignite has proved a success, and there has been no trouble in forcing the boilers thus fired up to loads well beyond their normal rating. Hoyt lignite is used at Tyler, the freight rate from the mine being 50 cents per ton. A representative of the Temple company reported that lignite is also now being burned with success in his plant, after precautions were taken to increase the height of the stack to improve the draft.

Dr. A. C. Scott, Dallas, called attention to the marked difference in the qualities of lignite mined in different sections of Texas. The ash content of such lignite, he pointed out, is of the greatest importance in producer operation. The combustion of lignite containing 7500 to 8000 heat units, at 60 per cent efficiency and $1.50 per ton, is about equivalent to oil fired at 75 per cent efficiency, the oil containing 18,500 heat units and costing $1 per barrel. The heat-unit value of lignite will vary, however, with the conditions of mining, transit, etc. For the proper combustion of lignite, continued Dr. Scott, the grate bars should be at least 24 in. from the boiler shell, the exact distance depending on the moisture content of the fuel. Troubles with lignite as fuel have been due chiefly to slow burning, but this difficulty can be solved by mixing the fuel with bituminous material of a higher grade. Thus a half-and-half mixture of lignite and McAlester slack burns very well. To get full steaming capacity it is advisable to provide a Dutch-oven furnace and a high stack. The cost of handling lignite has averaged on test from 8 to 12 cents per ton, suggesting the employment of some simple and efficient conveyor. Comparing oil at $0.93 per barrel with lignite at $1.15, there is a saving shown in favor of oil, concluded the speaker.

Mr. John A. Walker, San Angelo, recounted how his company had changed to lignite after oil rose in price from $0.95 a barrel to $1.15. After trying lignite for eighteen months the use of oil was resumed, owing to the trouble of handling the lignite, which had to be hauled 1½ miles at an expense of $150 a month. A lignite-burning plant, said Mr. Walker, offers some difficulties when emergency conversion to oil burning is attempted. Prof. F. C. Bolton observed that after three years' experience at the Texas Agricultural and Mechanical College the burning of oil at $1 per barrel is less expensive than lignite at $1.50 per ton. When available, lignite screenings are cheaper than either. On the subject of energy costs a central-Texas operator testified that he was producing a kilowatt-hour at the switchboard for an outlay of about ⅓ cent for oil.

Mr. Frank E. Scoville, Laredo, said that while lignite requires a larger boiler equipment for the same output, it was his experience while operating a plant at Austin that this low-grade fuel was more satisfactory and cheaper than cannel coal mined only 26 miles away. Another speaker declared, however, that wherever lignite is to be used some auxiliary means must be provided for forcing the boilers, and that some mechanical device should be arranged for conveying the fuel from the cars to the furnaces. Mr. E. S. Fletcher, Temple, insisted that the successful burning of lignite is only a question of heavy draft and increased grate surface.

After six months' experience with lignite burned under the combined draft of a 22-in. turbine-driven blower and a 115-ft. chimney, 7 ft. in diameter, Mr. P. J. Hays, Palestine, reported that no difficulty was encountered in carrying 75 per cent overload on the boiler units, as has also been done with oil firing. At Palestine the fuel is stored in wooden

bins in a brick building, the bins being 7 ft. above the boiler-room floor. If the labor of handling lignite could be reduced by the aid of mechanical conveyors, the cost of operation would be appreciably decreased. While the slack lignite produces no smoke, it gives rise to a whitish fog and makes ash in the ratio of 132 wheelbarrow-loads to 32 tons of lignite.

PURCHASING COAL ON A HEAT-UNIT BASIS AT SPRINGFIELD, OHIO

The Springfield (Ohio) Light, Heat & Power Company purchases coal for its steam-turbine station on a heat-unit basis, specifying the following preferred analysis for non-coking coals of approximately 14,000 heat-unit content: Moisture, 1 per cent; volatile matter 33 per cent; fixed carbon, 60 per cent; ash, 6 per cent. The quantity of sulphur present must not be more than 0.8 per cent.

As the cars are being unloaded samples are collected in a single container and then crushed and quartered as rapidly as possible to prevent the escape of moisture, the crushing and quartering being continued a sufficient number of times to secure about 5 lb. of a quantity small enough to pass through a 0.25-in. screen. During this process the largest piece in the portion of the sample remaining should never be more than 0.1 per cent of the total weight of the portion. The final portion of the sample is then divided into three parts, each equal fraction being placed in a glass or metal receptacle with tight-fitting cover. One of these samples is then forwarded to the shipper, the second is sent to the central-station company's analyst and the third is retained for record, to be submitted to a disinterested chemist in case of controversy between the shipper and the company. The bomb calorimeter method of analysis, recommended by the American Chemical Society, is used in determining the heating value of the sample.

While no reduction is made in the price of the coal for deficiencies up to 300 heat units below the specified content, for all deficiencies in excess of 300 heat units the following formula is applied:

$$\text{Contract price} \times \frac{\text{heat units in dry coal delivered}}{\text{heat units specified in dry coal}} = \text{price paid.}$$

The deduction for ash in each ton of dry coal in excess of the percentage guaranteed in the bidder's proposal is made on the following basis:

1 to 2 per cent	1 cent per ton
2 to 3 per cent	3 cents per ton
3 to 4 per cent (if accepted)	6 cents per ton
4 to 5 per cent (if accepted)	10 cents per ton

For sulphur present above the percentage guaranteed in proposal:

Up to 0.25 per cent of dry coal, deduct	1 cent per ton
Up to 0.25 to 0.50 per cent of dry coal, deduct	3 cents per ton
Up to 0.50 to 0.75 per cent (if accepted), deduct	6 cents per ton
Up to 0.75 to 1 per cent (if accepted), deduct	9 cents per ton

For all coal not delivered in self-clearing hopper-bottom cars the dealer is penalized 5 cents per ton. A record of the shipping weight of each car must, by agreement, be mailed to the customer within three days after the coal is delivered to the railroad at the point of shipment. Any change in the freight rate ruling at the time of the contract similarly affects the delivered price of the coal. For the protection of the company it is also agreed that in case of the contractor's failure to deliver his quota of coal the company may purchase fuel in the open market in such amounts as are necessary, charging the contractor with any excess difference between the price of such coal and the contract price.

The company may reject the coal and nullify the contract if at the end of a service test of ten days' duration the coal supplied fails to give satisfactory results when burned in a model furnace or chain grate at a rate not exceeding 30 lb. of coal per square foot per hour.

It is also agreed that coals containing sulphur exceeding 1.25 per cent on the dry coal, ash exceeding the established standard by 3 per cent, or volatile matter exceeding 40 per cent, are subject to rejection, at the option of the company. If accepted, reduction in price is made for sulphur and ash, as shown above.

STARTING SWITCH FOR ALTERNATING-CURRENT MOTORS.

Mr. F. G. Dustin, city electrical inspector of Minneapolis, Minn., has devised and secured patents for an improved starting switch for alternating- current motors up to 5 hp in size. Turning the switch handle to the first starting position supplies energy to the motor through heavy starting fuses, a series-coil interlock preventing the handle from passing beyond the starting position until the current taken by the motor has fallen to its normal running value. When this has occurred the interlock is released, permitting the handle to be turned further in the same direction to the second or running position, which is fed through lighter fuses, the change of connections being established without interruptions of the supply circuit to the motor. The switch handle is held in the running position by a no-voltage relay coil. In case the supply should fail for any reason, this coil at once releases the switch handle, allowing it to return to the "off" position. The series coil is also made to include the functions of an overload circuit-breaker, through connection with this release mechanism. Should the load on the motor increase above a predetermined value, the series coil operates, causing the no-voltage release mechanism to return the switch to the off position. The same no-voltage coil can also be utilized for distant-stop

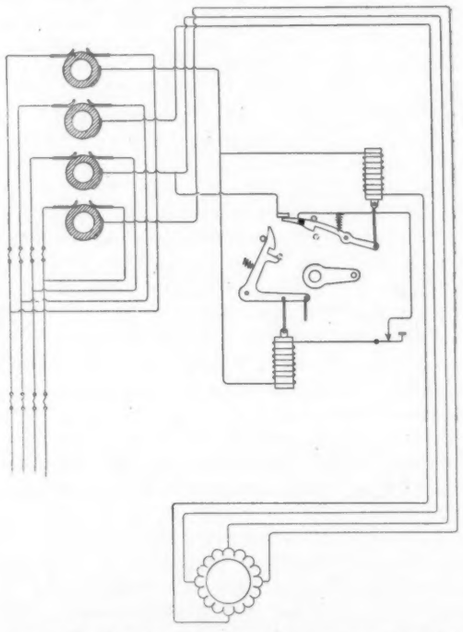


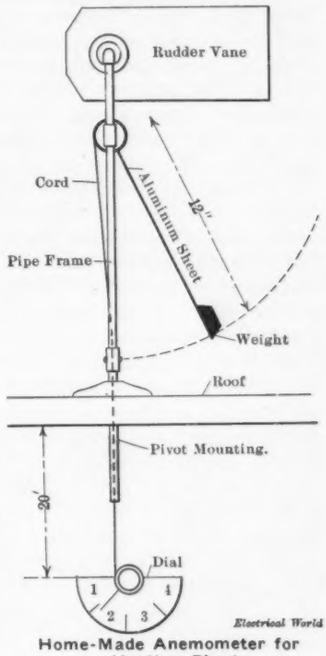
Diagram Showing Operation of Starting Switch for Alternating-Current Motors.

control. All contacts on the switch are self-scouring and self-aligning. Use of the device should eliminate the unnecessary blowing of fuses and the expense of replacing them, at the same time affording proper fusing during running, as the motor is protected under all conditions. The series overhead can be set to operate at any fixed current value, and can be sealed against tampering.

HOME-MADE ANEMOMETER FOR HEATING PLANT.

The demand for steam or hot water on a central heating station depends as much on the velocity of the wind outside as upon the actual outdoor temperature. Of these changes the engineer, perspiring in a thin undershirt inside of the plant, is likely to be quite unconscious without some kind of an indicating device.

A standard cup anemometer for measuring wind velocity costs about $275, and as this outlay seemed excessive to the engineers of the Public Service Company of Northern Illinois, the simple home-made outfit illustrated herewith was built and erected on the plant at Chicago. It comprises a sheet of aluminum, 8 in. by 12 in., weighted at the bottom and suspended at its upper edge from the pipe frame shown. Above and at right angles to the plane of the sheet is a rudder vane which holds the sheet square with the direction of the wind. A cord passing over the top of the sheet is brought down to an indicator pulley in the engine room. This dial is divided into four parts, each of which is the signal for putting into force the corresponding schedule of pressures and flow temperatures, depending on the outdoor temperature at the time. The requirements outlined have been obtained by experience with the actual needs of the system for the given temperature and wind velocities, an extensive schedule being drawn up.



Home-Made Anemometer for Heating Plant.

For example, anemometer division No. 1 indicates a wind velocity of 0 to 2 miles per hour, and with 32-lb. flow pressure calls for a hot-water delivery temperature of 120 deg. Fahr., with the return flow at 100 deg. Division 2, 3 to 10 miles per hour, requires 135 deg. outflow and 118 deg. return. Division 4, indicating 25 to 50 miles per hour wind velocity, calls for 45 lb. flow pressure and a temperature of 215 deg., with return at 156 deg. Variations in temperature are accounted for by raising the initial heat of the water 1 deg. for each degree of temperature fall outside. Thus the same schedule is in force for a 25-deg. wind blowing at 25 to 50 miles per hour as in the case of zero weather with no wind. This home-made anemometer has been checked with the indications of the standard government instruments and is found to be in close accord with the latter's readings for all ordinary winds.

LABOR INCENTIVE OF MACHINERY.

A practical construction superintendent calls attention to the psychological effect on workmen on a job when some piece of power-driven machinery such as a concrete mixer, conveyor or other moving device is running. According to his experience, supplemented by careful cost and time study of jobs, common labor is rendered 50 to 75 per cent more effective when working about moving machinery. Not only does the recurring demand of the machine set a pace for the workmen, but the rhythmical noises produced by motor, gears, parts, etc., seem to produce genuine stimulation of the men's lagging energies and they work faster while they work, although perhaps waiting at the end of the turn for the machine's cycle to catch up with them.

This experience seems to bear out the practice on certain battleships where the band is required to play quick, stirring marches during the operation of coaling ship. Here, again, the time necessary to complete a given piece of work is cut down, and the ship's coal is stowed away expeditiously. The contractor who installs motor-driven apparatus substitutes inexpensive electricity for the relatively expensive power of human muscles. But, more than this, he increases the efficacy of such labor as he still needs to employ, for even the stolid "hunkie" or lazy negro will respond with renewed activity to the inspiriting whir and rattle of motor-driven machines.

SAFETY-STOP SWITCHES FOR CONVEYOR.

With several hundred feet of heavy machinery in motion on different levels and out of sight of the controlling switch, as in the case of a bucket conveyor in a power house, it is important to have some means of stopping the conveyor from several points, holding it positively "shut down" until the man who caused the stoppage is ready to have it started again. Sometimes a bucket becomes inverted or some part gets out of place, which might cause serious damage if the conveyor continued to run. If the attendant who notices the trouble can immediately shut down the motor without losing time to run to the main switch (which may be on another level), damage and expense may often be averted. The man who goes onto the conveyor after thus stopping it should also have assurance that the machinery will not be again started without his knowledge. To prevent personal injury the automatic-stop feature should make it impossible to start again until every station is in readiness.

Such a safety control is effected in a Chicago power plant by including in the circuit of the holding coil on the automatic motor starter a number of knife switches which are located at the principal points of the conveyor travel. There is one at each turn where buckets are likely to become upset, and others at the mid-points of the vertical and horizontal travels. As the sketch shows, these switches are wired in series, using about 500 ft. of No. 12 wire. Opening any one switch breaks the holding-coil circuit of the automatic starter, thus releasing the contact arm and stopping the motor. When the open safety switch is again closed the solenoid plunger is again actuated, performing the normal starting cycle. If any of the switches has been opened while the conveyor is at rest, even closing the main switch will not start the motor. This feature permits a workman going into the conveyor to make repairs to pull the safety switch nearest him, after which he can work without danger or possibility of the motor starting. The expense of installing this safety-stop provision is not excessive, and the investment is sure to prove its worth in preventing injuries to men and serious damage to machinery.

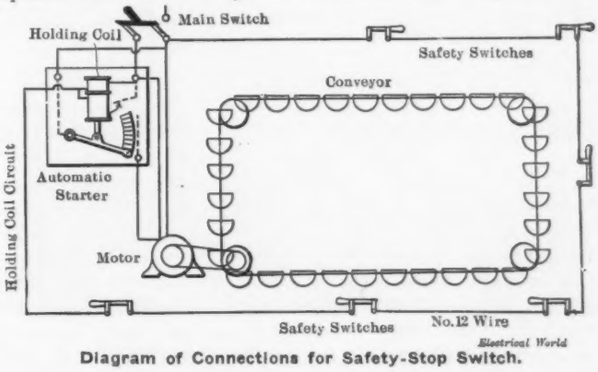


Diagram of Connections for Safety-Stop Switch.

Central Station
Management, Policies and Commercial Methods

ELECTRICITY AS A DETERRENT FOR SUICIDES.

Hotel and inn keepers through the country are often put to great trouble because some of their guests commit suicide by inhaling the illuminating gas with which the bedrooms are lighted. Hearing of an attempted suicide by illuminating gas at a hotel in Brooklyn, a district agent of the Edison Electric Illuminating Company of Brooklyn called on the owner of the hotel and, after some little persuasion, induced him to replace gas in all of his sleeping rooms with electricity, this resulting in the installation of twenty-eight 20-cp lamps. Shortly after the same agent read the account of another attempted suicide at an inn and, encouraged by his previous success, called on the proprietor of the inn and suggested that he wire the upper floor of his building, which was arranged for hotel purposes. After the proprietor had thought the matter over, he felt that the suggestion was not at all a bad one and signed a contract for ten 20-cp lamps, in addition to his first-floor equipment, the upper part of the structure having been lighted by gas.

TOASTER CAMPAIGN IN BYLLESBY PROPERTIES.

As the result of a one-week toaster campaign held in a number of the cities where central stations are operated by H. M. Byllesby & Company, more than 400 toasters were placed. In some of the cities, as the result of the special interest created by the campaign, more electric toasters were sold during the week than had been disposed of during the preceding year. A coupon plan was used, advertisements appearing in the local papers carrying a coupon which was redeemable for the value of $1 if applied to the purchase of a standard $3.50 toaster, making the net cost to the customer $2.50. A similar scheme was adopted in an electric-grill campaign carried on about the same time as the toaster campaign. In a few of the cities, owing to various local conditions, the number of devices sold was small, but in most places the results were very gratifying and fully repaid the efforts made to place additional devices on the lines.

Among the cities where the success of the campaign proved the value of the idea were the following, with the population served and the number of toasters sold: El Reno, Okla., 8,000, 51; San Diego, Cal., 65,000, 56; Oklahoma City, Okla., 65,000, 46; Minot, N. D., 6600, 19; Enid, Okla., 14,000, 15; Fargo, N. D., 15,000, 21; Sioux Falls, S. D., 14,000, 39.

CONSOLIDATIONS AND STREET-LIGHTING RATES.

The purchase of a small central station by a large organization supplying service at established rates in a number of municipalities sometimes leads to complications in the matter of prospective rates in the community taken into the greater system. The general principle of applying the standard rates of the larger company to all portions of its territory is obviously the correct one to follow in laying down an administrative policy, but local conditions frequently prove embarrassing in working out the problem. Often the small company has in force contracts which must be carried out, even at the risk of incurring charges of discrimination in other parts of the larger territory, and which can be retired only as fast as their legal periods expire. Again, low or perhaps unprofitable rates may be in force on some special class of business, such as street lighting, and when the larger company puts its own standard rates into effect the municipality or a certain class of consumers may have to pay more for service than under the old régime.

To deal fairly and skilfully with situations of this kind requires great negotiative ability and no small amount of technical insight. Where written agreements exist as the basis of prices, about the only thing which can be done is to persuade the parties at interest to cancel the contract in favor of a new agreement, or else abide by the conditions without attempting to conceal their character or the reasons for such a policy. Much advantage can be taken of the fact that superior service will probably be rendered by the larger organization. In a noteworthy instance of this kind a large company purchased a small local plant and applied to the authorities of the State for permission to issue securities to carry through the deal. At the public hearing it developed that the street-lighting bills in the town would be increased about $339 per year with the new and improved service, since the standard rates of the larger company throughout its entire territory were somewhat higher for the types and sizes of lamps involved. The company maintained that in the absence of a lighting contract with the town it could not consider the establishment of any other than its regular rates, and incidentally raised the question whether the small plant had not been attempting to carry the street-lighting load for less than an adequate return.

Throughout the negotiations the company vigorously refused to introduce any discriminations in rates, but for the benefit of the town and the information of the commission showed that the introduction of the new service would result in a saving to commercial lighting customers amounting to about $4,357, leaving a net saving to the community of $4,018. In other words, the small company had charged 15 cents per kw-hr. for commercial lighting, compared with 10 cents charged by the large company, and this difference was far more than sufficient to offset the slightly higher street-lighting bills. It was also shown that under the street-lighting rates of the larger system lamps of increased size could be operated at a lower yearly cost than under the rates of the old company, for the reason that the rates of the larger organization were based on a fixed charge per lamp per year plus an operating charge per lamp-hour, which permitted doubling the service with only a slight increase in price, while the small company doubled its rates with the corresponding increase in service.

RURAL SERVICE TO 700 FARMERS NEAR STOCKTON, CAL.

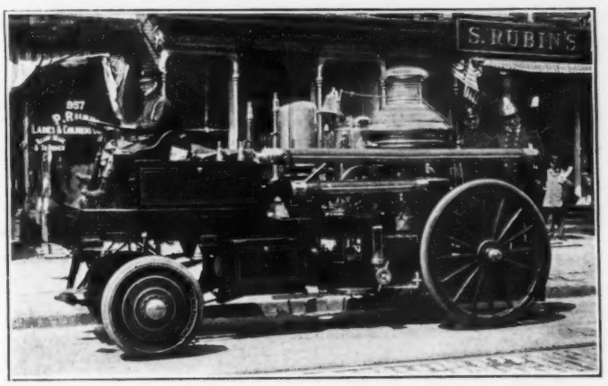
Within the last four months more than 60 miles of secondary distribution lines have been built through the rich and productive farming country of the Sacramento and San Joaquin valleys near Stockton, Cal., by the Western States Gas & Electric Company. This central-station system now has a connected load of nearly 2000 hp in the irrigation and farm service of some 700 ranchers. The present network of secondary lines, built at an outlay of $90,000, covers 80 square miles of the best farming country, and has been laid out with extensions in view which will cover 200 square miles.

Irrigation forms an important part of farming operations in this region, the addition of water to the land multiplying the productiveness from two to ten times. Irrigation plants operated by central-station service are always ready for use, and are started and stopped with no more

effort than throwing a switch. Such power service is, of course, a great boon to the small farmer, and enhances the value of all land reached by the lines. The rates for electric service offered by the Western States Gas & Electric Company, which is managed by H. M. Byllesby & Company, are as follows: First 1000 kw-hours, 3 cents per kw-hour; second 1000 kw-hours, 25 cents; third 1000 kw-hours, 2 cents; fourth 1000 kw-hours, 1.5 cents. With electric power for irrigation, great crops of asparagus, celery, potatoes, onions, beans, grapes and deciduous fruits are now made possible in this section. Within three months 1500 hp, mostly in small motors driving irrigating plants, have been connected to the central-station lines, and the prospective business in sight will shortly bring the connected load up to 2500 hp. The headquarters of the Western States operating division in the central California territory are at Stockton, where Mr. W. W. S. Butler is general manager.

CONVERTED FIRE ENGINE.

As demonstrating the progress made by the electric vehicle for all commercial and city purposes, the converted fire engine shown herewith is of interest. This engine was one of the horse-drawn type in general use in Brooklyn and was rebuilt by Mr. F. J. Hinners, Jr., electrical engineer, of New York. It is equipped with an 80-cell lead battery, and it operates by means of a coupled-gear, two-front-wheel



Converted Fire Engine.

drive. The total weight of the fire engine is 8 tons, and it is guaranteed to travel 20 miles an hour on level streets and to attain a speed of from 8 to 10 miles an hour on a 12 per cent grade. Two batteries are charged from the Brooklyn Edison circuits through a Westinghouse charging board, which has been installed in the engine house, and if the engine is as successful as anticipated, all of the horse-drawn Brooklyn engine trucks will, in all probability, be similarly reconstructed. It will be understood, of course, that electricity is used merely to operate the truck, and not the engine located on it.

LIGHTING MOTION-PICTURE THEATERS DURING PERFORMANCES.

After Jan. 1, 1913, according to a recently passed ordinance of the City Council of Chicago, every portion of a motion-picture theater in that city, including exits and corridors, must be lighted by electric lamps during all performances and until the entire assemblage has left the premises. The lighting during performances must be such that a person with normal eyesight shall be able to read Snellen's standard test type 40 at a distance of 20 ft. and type 30 at a distance of 10 ft. Normal eyesight is taken to mean the ability to read type 20 at a distance of 20 ft. in daylight. A card showing types 20, 30 and 40 must be displayed prominently in the corridor of the theater, together with a copy of the ordinance.

A TRAVELING ELECTRIC SHOW.

The Albany Southern Railroad Company supplies electricity to the cities of Rensselaer and Hudson, N. Y., as well as to a large rural and village territory between these places. To induce those living in villages to travel

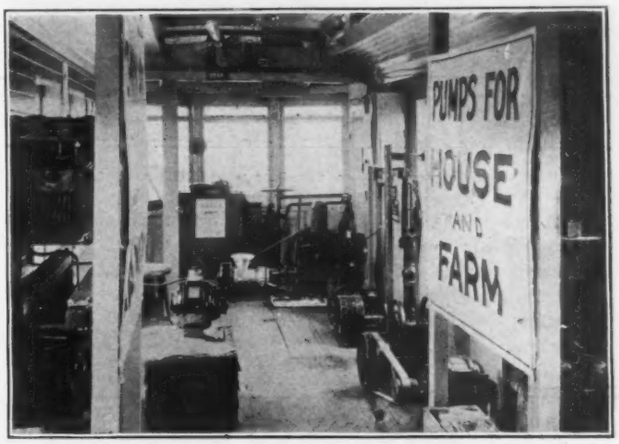


Fig. 1—Exhibit of Motor-Driven Appliances.

considerable distances to the display rooms maintained by the company at Hudson and Rensselaer has been a difficult matter, and to obviate this it was recently decided to take a display to the various villages by means of cars especially equipped for that purpose.

The "Electric Special," a train of two cars, was equipped with a full line of electrical appliances such as motors, pumps, mills, suction cleaners, washing machines, etc., and

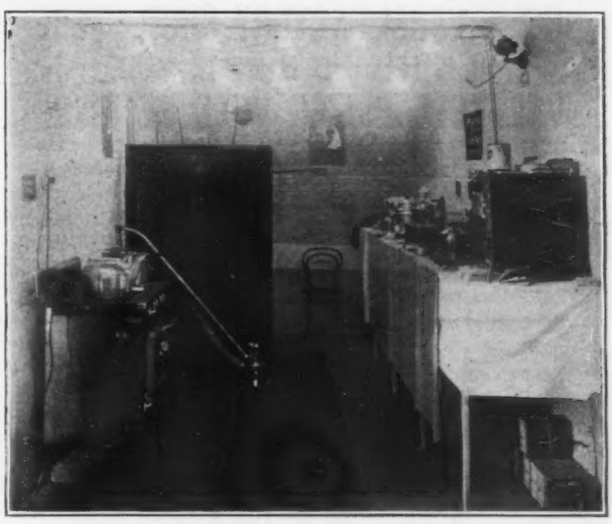


Fig. 2—Electric Cooking Apparatus in Freight Car.

scheduled for a one day's stop at each of the stations in the territory served.

The running of this train was thoroughly advertised by the distribution of circulars, one of these notices being left at every house about one week ahead of the arrival of the train and another notice being delivered at each house after the train had arrived at the station.

One car was devoted to devices requiring motor drive for their operation—large and small pumps, both directly connected and belted, coffee mills, bone and meat grinders, different types of electric washing machines, and several applications of the pump jack for transforming windmill and house pumps to motor-driven outfits. The other car,

Fig. 3—Exhibition Cars for Traveling Electric Show.

which was a standard freight car lined throughout with white bunting, was arranged to exhibit to the best advantage a full line of electrical devices for household use, counters being erected along the sides and ends. This car contained a demonstrating kitchen including electrical range and oven, chafing dishes, coffee percolators, toasters,

The Electric Special
A TRAVELING ELECTRIC
SHOW
THE ONLY ONE ON EARTH
Exhibiting and Demonstrating an Interesting Collection of Electrical Devices for the
HOME, FARM, FACTORY, SHOP, STORE
IT IS FREE—IT IS WORTH WHILE
VALUABLE PRIZES WILL BE GIVEN
ELECTRIC
Motors, Lights, Flat Irons, Pumps, Water Heaters, Ranges, Tea Kettles, Coffee Percolators, Chafing Dishes, Toasters, Broilers, Grills, Stoves, Radiators, Washing Machines, Suction Cleaners, Bone Grinders, Coffee Grinders, Fans, Fixtures, Portables, Cigar Lighters, Battery Charging Sets, Signs.
SCHEDULE
East Greenbush, Aug. 19
East Schodack, Aug. 20
Nassau, - - Aug. 21
North Chatham, Aug. 22
Niverville, - - Aug. 23
Valatie, - - Aug. 25
Kinderhook, - Aug. 26
Stuyvesant Falls, Aug. 28
Hudson, - Aug. 29-30
Rensselaer, - Aug. 31
Electric Park (At Farmers' Convention), Aug 24
SIDE-TRACKED AT THE STATION
C. D. 2
The Albany Southern

Fig. 4—Poster Advertising the Traveling Electric Show.

water heaters, etc., all connected and in use. Biscuit, toast, muffins, cake, candy, coffee, etc., were made and served to visitors. Electric fans and an ozonator took care of the ventilation in a most satisfactory manner.

The results of the trip were fully up to expectations, the people turning out in large numbers and showing great interest in the exhibition. Many appliance sales were made and one of the most gratifying results was the large number of prospective customers thus reached. The company states that the number of orders taken for motor-driven appliances has fully justified the effort made.

The train was in charge of Mr. E. K. Ford, the commercial agent for the company, assisted by the company's solicitors and representatives and demonstrators from the various supply houses. The company was so gratified with the results that in all probability a similar trip will be made next year.

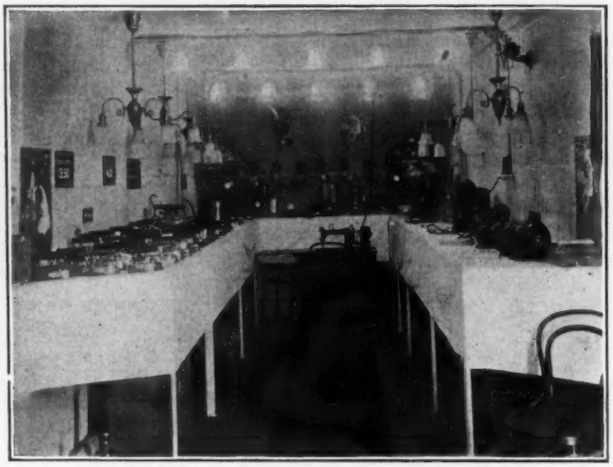


Fig. 5—Exhibition of Electrical Household Devices.

ELECTRIC DEEP-WELL PUMPING.

By J. E. Bullard.

There is probably no load which is more profitable to the average central station or that it is more desirous of obtaining than city water pumping. The average pumping plant, however, is steam-driven and contains a quantity of expensive machinery which must be junked or disposed of at a sacrifice before electric pumps can be used—a condition which adds greatly to the difficulties of getting this very desirable class of business. On the other hand, the rapid increase in population and consequent contamination of previously good water supplies makes the problem of an adequate supply of pure water a more and more serious one for many cities. This fact is leading to a very extensive use of deep wells, and when deep wells are drilled the central station has an opportunity which it cannot afford to neglect. Deep-well pumping is almost entirely an off-peak load and is also an entering wedge toward eventually getting the rest of the pumping. The following history of a deep-well pumping contract in southwestern Missouri and a description of the pumping plant bear on this subject.

The Webb City & Carterville Water Works Company, of Webb City, Mo., recently found its supply of water from Center Creek so unsatisfactory that it was decided best to drill deep wells. Accordingly a contract was let for four 14-in. wells to be of sufficient depth to furnish pure water at the rate of about 350 gal. per minute. The wells as finally drilled varied in depth from 1000 ft. to 1200 ft. This water company is a private corporation with its rate regulated by franchise. It was, therefore, of the utmost importance that the water from these wells should be pumped in the cheapest way. In order that no mistakes should be made in determining the best method of pumping to be adopted, the officers of the company began a very thorough investigation into the relative merits and costs of the various methods in common use. They visited plants using compressed air, steam-pump heads and lift pumps driven by various forms

of power. The Empire District Electric Company lent its aid in making tests and in getting data on electrically driven plants.

A test was run on a pump geared to a 20-hp motor. This pump was delivering 200 gal. per minute and as nearly as could be ascertained was working against a total head of 200 ft. The test showed an electrical input into the motor of 0.9 kw-hr. per 1000 gal. of water pumped. This result being highly satisfactory to the water company, it immediately began to investigate the central station's ability to furnish reliable and uniform service. In this investigation the Empire District Electric Company was as anxious to aid as it was in the pumping investigation. Automobiles were furnished to convey the water company officials to the generating plants, to take them for a tour of inspection of the transmission system and to aid them in visiting power users who for some time had been central-station customers.

After thus very thoroughly investigating the question on all its sides, the water company finally decided to pump the water with double-acting deep-well pumps geared to motors and to buy the energy from the Empire District Electric Company. This decision was made in face of the fact that the company could buy natural gas at 12½ cents per 1000 cu. ft. for boiler firing and 25 cents for gas-engine use and that coal delivered to the bin would never cost more than $2 per ton. It may be well to state at once that the main generating plant of the Empire District Electric Company is a coal-fired steam plant.

The present installation of the water company is laid out as follows: There are four double-acting deep-well pumps with working barrels 8 in. in diameter. These pumps work against a head of about 250 ft. and deliver about 300 gal. of water per minute. The wells are at a distance of from 75 ft. to 300 ft. from the corners of a new 1,500,000-gal.

Fig. 1—Pump House for Electric Deep-Well Pumping.

concrete reservoir into which the water is pumped. Each pump is geared through the medium of a cut gear and a rawhide pinion to a 25-hp, 220-volt, 720-r.p.m., 25-cycle, three-phase motor with a squirrel-cage rotor. All the starting and control apparatus for the motors is located in the switchboard room which adjoins the engine room. This makes the pump-house equipment simple and reliable. The reservoir into which the water is pumped holds it in storage till it is pumped into the mains through the steam-pressure pumps which have for years been in use in the old pump house located just north of the reservoir. The south side of this pump house has been extended to form a switch and

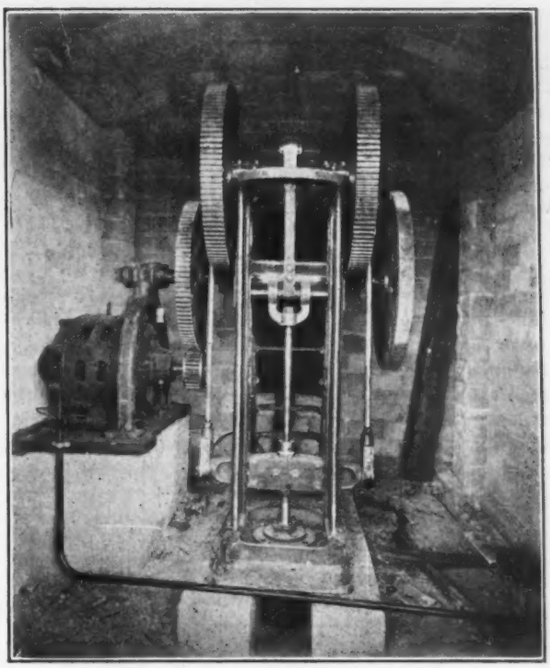


Fig. 2—Electrically Driven Pump.

transformer room which will be readily accessible to the engineer.

The Empire District Electric Company delivers its energy to the leads brought out from this switchboard room at 2200 volts. The circuit passes through disconnecting switches and lightning arrester choke coils to the incoming line panel, where it can be cut out or in by means of an oil switch. From this panel the circuit goes to three 37½-kw, 2200-220-volt transformers, where the tension is stepped down to the motor voltage and energy led to the motor control panels through busbars. The transformers also supply 110-volt energy to the lighting panel. There are at present five motor panels. This leaves a spare one for emergency use until such time as it is needed for another well. Each motor panel has all the control and starting apparatus mounted at the back. The only part of the apparatus visible from the front is the handle of the double-throw switch. Above this handle is mounted an ammeter. The ammeter is used to show the operator when the motor reaches full speed after starting and also to indicate by the energy consumed when the pump is taking air or anything else is wrong with it. Each panel is also equipped with an overload and no-voltage release as a further protection to the pump and motor.

The Empire District Electric Company's wattmeter is mounted on the incoming line panel, as is also a curve-drawing ammeter used to indicate whether all the energy has been used off the peak. On the front of the lighting panel is mounted a two-pole knife switch for each of the well circuits and one for the engine-room circuit. This seven-panel switchboard is so placed as to be readily accessible and plainly seen from the steam pump or engine room. It has proved very effective in controlling the operation of the pumps and in saving labor. In appearance it is superior to many switchboards to be found in the generating and substations of small central stations.

The installation has now been in operation for a sufficient

length of time to demonstrate that the energy consumption is no higher than was estimated from the data obtained by running the tests on the other pumping plants. On an average about 1,000,000 gal. of water per day is pumped.

From what has already been said it is quite apparent that, if not a deciding factor in getting the contract for the central station, at least an important factor in so doing was the aid extended in getting reliable information on deep-well pumping. It happened in this instance that the central station was able to get more reliable information on electric pumping than was forthcoming from any other quarter. This and the courteous treatment and prompt attention given to all the officers of the company in their quest for reliable information were instrumental in securing the contract.

WHY LIGHTING BILLS INCREASE.

The chart reproduced herewith, posted in the offices of the lighting department of the Kokomo, Marion & Western Traction Company, at Kokomo, Ind., helps explain to customers the inevitable increase in their bills as summer merges into fall and fall passes into winter. While the tabulation of hours of light and darkness is perhaps not

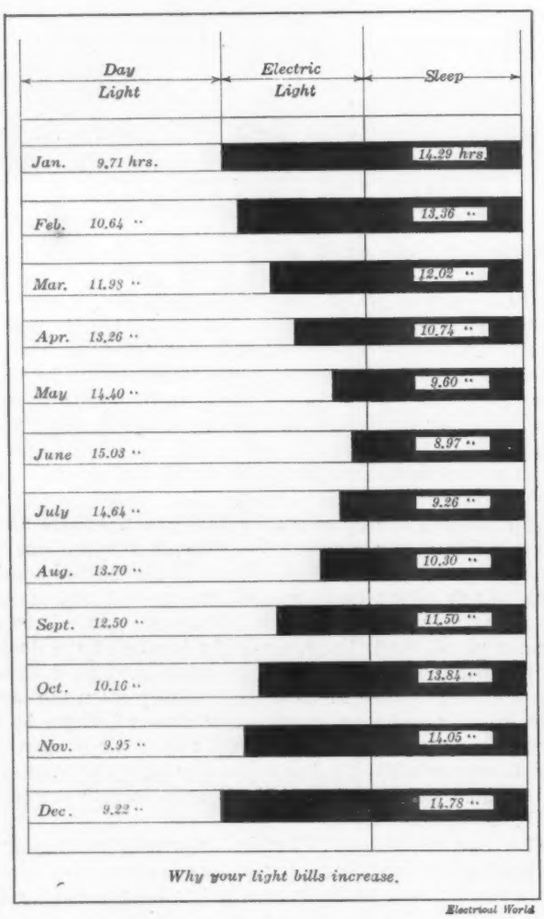

Day Light
Electric Light
Sleep
Jan. 9.71 hrs. 14.29 hrs
Feb. 10.64 " 13.36 "
Mar. 11.98 " 12.02 "
Apr. 13.26 " 10.74 "
May 14.40 " 9.60 "
June 15.03 " 8.97 "
July 14.64 " 9.26 "
Aug. 13.70 " 10.30 "
Sept. 12.50 " 11.50 "
Oct. 10.16 " 13.84 "
Nov. 9.95 " 14.05 "
Dec. 9.22 " 14.78 "
Why your light bills increase.
Electrical World

Chart Explaining Increase in Lighting Bills During Winter Months.

new, Mr. O. M. Booher, local contract manager, has conceived the original idea of marking off the hours of sleep by a vertical line which leaves as a margin the hours of darkness when electric light is required. Thus, allowing eight hours for sleep, the "electric-light hours" are seen to range from six and three-quarters hours in December to less than one hour in June.

ELECTRIC SERVICE TABLE.

Electric service is often desired in unwired residence buildings where the trouble and expense of installing wiring, meter, switch, etc., is beyond the means of the occupants or the value to them of such service. To provide this class of residences with a self-contained electrical installa-

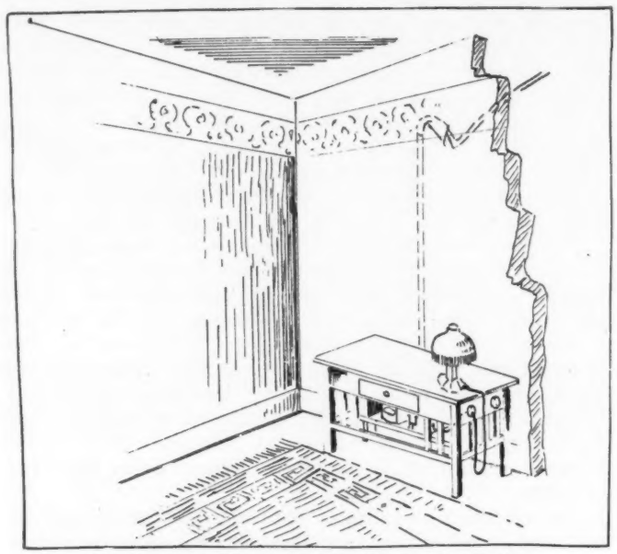


Fig. 1—Connections for Electric Service Table.

tion which makes available the operation of a fan, iron, percolator, vacuum cleaner, sewing machine, reading lamp, etc., Mr. W. E. Clement, contract agent of the New Orleans Railway & Light Company, has devised the electric service table here illustrated. This is simply a standard library table arranged with four or more outlets or plug sockets located on the sides, where they are out of the way. In the frame of the table is concealed an iron box containing the meter, main switch, fuses, wiring, etc., making the device a complete and self-contained electrical installation and providing ready and convenient means of connecting house-

Fig. 2—Electric Service Table.

hold appliances and lamps without the necessity of wiring the premises. Connection to the outside lighting mains is made through a run of conduit leading from the iron meter box through the baseboard and up the outside wall of the building. When installed this conduit is well grounded. Mr. Clement has applied for a patent on this ingenious arrangement.

Wiring and Illumination

SERVICE FOR MOVING-PICTURE ARC LAMPS.

Methods of supplying moving-picture machines with energy in a form suitable for the operation of projection arc lamps were discussed in connection with the "Question Box" at the recent Joplin convention of the Missouri Electric Association. Replying to the question, "In justice to both consumer and power company what requirements should the company make in regard to voltage-reducing apparatus for moving-picture machines, especially with reference to power factor?" one correspondent pointed out that the company's first duty is to educate the customer concerning the operation, advantages and disadvantages of the various methods of voltage reduction, after which the selection should rest with him. The central-station desires, of course, to give customers the best service at the least cost, but if they are not willing to follow its advice, poor policy would be displayed in requiring the use of any one form of voltage-reducing apparatus.

In general there are four ways of handling a moving-picture arc lamp from the ordinary alternating-current distribution system. A transformer stepping down to 50 volts or 80 volts can be used to furnish alternating current for the arc, but such an arc is unsatisfactory, consuming large current; the arc also tends to wander, thus changing the focus of the lamp, and, moreover, has an objectionable color and is noisy. A motor-generator may be employed to furnish direct current at suitable voltage for the arc, but here both efficiency and power-factor are low and the consumption correspondingly disproportionate to the service. Mercury-arc rectifiers have been used quite largely, on account of their superior efficiency and fair power-factor, as well as the satisfactory character of their operation. The green light from the tube also has an advertising value if installed in front of the theater. These tubes are subject to breakage, however, adding a source of expense and annoyance from the necessity of renewals. The single-phase rotary converter is one of the most recent developments for supplying moving-picture machines. Its efficiency is high, while its power-factor is adjustable from unity at full-load to 80 per cent leading at no-load. The converter can also be used as a power motor, if desired, and when not employed for furnishing direct current to the arc may drive a fan for blowing or drawing the dead air out of the auditorium during intermissions. This auxiliary application secures the central station the additional advantage of an improved load-factor.

ELECTRICAL ILLUMINATION AT HALIFAX.

An elaborate electrical display was a striking feature of the visit to Halifax, N. S., on Aug. 14 and 15 of the Duke and Duchess of Connaught and Princess Patricia, in connection with the dedication of a memorial tower and other exercises commemorating the one hundred and fiftieth anniversary of the founding of this overseas colonial government by the British Empire. During the two days' holiday-making numerous parades and formal functions took place, the climax being reached on the last evening of the royal party's visit, when there was an electric illumination of the Public Gardens. Under the supervision of City Electrician Colpitt, of Halifax, a handsome arch of welcome was erected at the main entrance of the gardens, about 150 red and white incandescent lamps of 8 cp each being formed into a greeting. The Jubilee Fountain, South African Fountain, band stand, duck house and other objects of interest were decorated with outline and display lighting, and the miniature waterfalls, bridges and shrubbery were also effectively treated with festoons of incandescent lamps and Chinese lanterns. A model of the royal steamship *Earl Grey* was also displayed in outline lighting. About 1000 110-volt lamps were used in the garden display, and these were supplied with energy by the Halifax Electric Tramway Company, Ltd., through a special transformer installation. During the evening the grounds of the Lieutenant-Governor's residence on Barrington Street and the front of the officers' mess on Spring Garden Road were electrically lighted, the latter displaying a crown outlined with incandescent lamps. The Halifax dockyard was also illuminated in honor of the Governor-General and his party.

On the evening of the 14th a regatta was held on the celebrated Northwest Arm of the waters inclosing the greater portion of the city, and the illumination was one of the most elaborate ever seen in the Dominion. Over 5000 incandescent lamps, ranging in size from 2 cp to 16 cp, were temporarily installed on shore and all the principal boat-club houses were outlined in light, as were the memorial tower, the British warship *Sirius* and numerous private yachts. A special submarine cable was run across the Arm by the tramway company to handle the tower lighting, and many private residences in the western portion of the city also contributed by special porch and interior lighting to the gayety of the occasion. The tramway company, which also supplies the electric lighting, gas and power service of Halifax, carried during the day and evening more passengers than it had ever carried in a similar period.

AUTOMATIC CONTROL OF CURB LIGHTING FED FROM EDISON SYSTEM.

The business section of Dayton, Ohio, is lighted by 360 340-watt tungsten clusters, divided into seven groups, each fed at a convenient point from the 220-volt Edison three-wire mains of the Dayton Lighting Company. Formerly controlled by hand from street switches, this lighting is now all manipulated practically simultaneously from the station switchboard, a novel magnet-switch scheme being used which has saved much of the wiring required with the usual distribution or pilot-wire controls. The scheme, which is due to Mr. O. H. Hutchings, general superintendent of the company, is illustrated in simplified form in Fig. 2.

Fig. 1—Ornamental Cluster Lighting at Dayton, Ohio.

Closing one of the control switches at the right energizes the magnet contactor of a nearby section. As this section lights up, it in turn energizes the contactor of section No. 2, and the action is repeated throughout the system, until the lighting of the last section is indicated by the pilot lamps on the switchboard. One switch thus controls the four lower 60-watt lamps on the posts, operated till midnight; the

other governs the single 100-watt units operated all night. Although not shown in the sketch to avoid complication, each group is itself balanced across the three-wire system, double-pole switches taking the place of the single contacts indicated. Fig. 3 shows a set of these 100-amp General Electric carbon-break contacts mounted, with the section

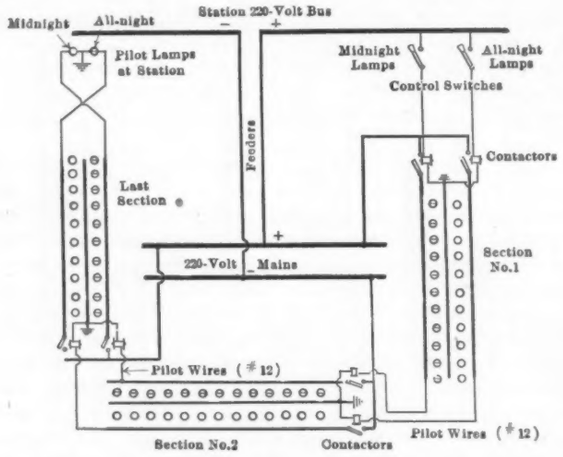


Fig. 2—Simplified Diagram of Curb-Lighting Control.

fuses and meter, in the 30-in. by 34-in. gasketed manhole box installed at the feeding point of each section. The meters are read once a month and the switches are inspected and cleaned at this time. Each magnet winding consumes about 0.3 amp at 110 volts in its holding position, and the contacts carry 58 amp to 90 amp.

From the closing of the control switch to the flashing of the corresponding pilot lamp, barely one second is required for the impulse to traverse the seven switches and a total distance of 10,500 ft. Half of this path is in No. 12 pilot-wire circuit, the average length of pilot circuit being 785 ft. The system cost $120 per switch station to install, exclusive of meters, and now saves about one-half hour's daily operation, due to irregular lighting, or about 60 kw-hr. per day, in addition to labor. It has been in operation two months and has proved entirely reliable. Half a mile from the nearest post-lighting circuit, the Dayton company also

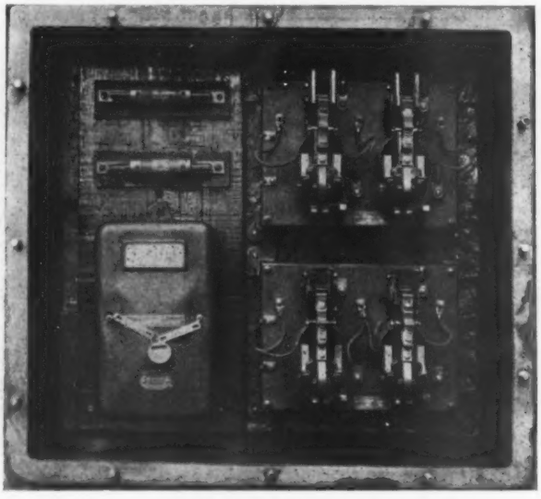


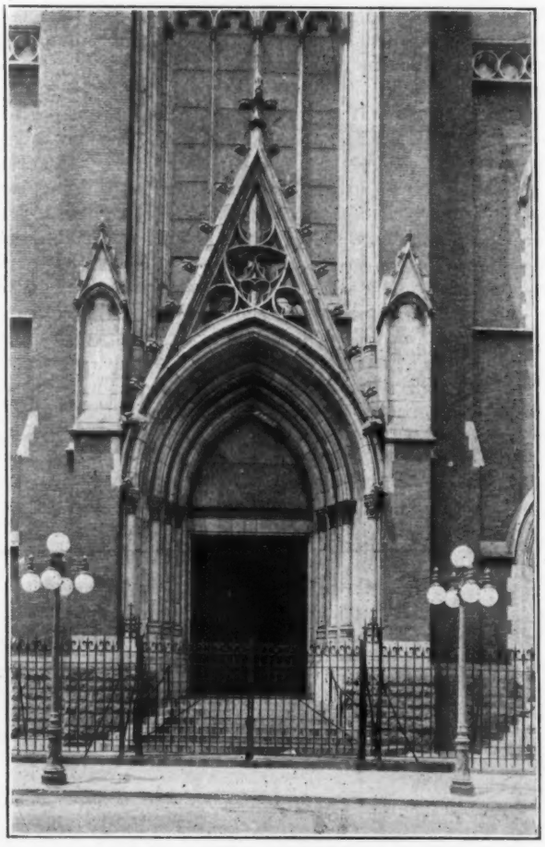
Fig. 3—Section Magnet Switches in Manhole Box.

lights a bridge with alternating-current multiple tungsten lamps, the control of which has been effected by extending a pilot circuit and magnet switch from the direct-current curb system, replacing an unsatisfactory time switch formerly used at the bridge.

The city pays directly for the Dayton curb lighting, itself bearing the cost of all corner posts and one-eighth of the others, and assessing the abutting property owners for the remaining seven-eighths at the rate of 74 cents per curb-foot per year. The cost of operating the curb system is $55 per 340-watt post per year.

TUNGSTEN-LAMP STANDARDS FOR CHURCH ENTRANCES.

It is a very common custom to install lamps at either side of church entrances, in order that worshipers may not stumble owing to the sepulchral darkness usually prevalent at such places at night. In many cities gas lamps are installed at the entrance at the expense of the city, and as a rule gas lamps predominate. The accompanying illustration shows two five-lamp ornamental lamp-posts which have



Tungsten-Lamp Standards for Church Entrances.

replaced the old gas lamp-posts in front of St. Leonard's Roman Catholic Church in Brooklyn. These lamps were installed by the ecclesiastic authorities, who also pay the Brooklyn Edison company for the energy consumed in lighting them. The rector of the church has expressed satisfaction with the installation and has even gone so far as to recommend similar installations to other Roman Catholic rectors throughout Brooklyn.

DECORATIVE FLAME-ARC LIGHTING FOR DEARBORN STREET, CHICAGO.

Within the next month Dearborn Street, Chicago, will be lighted from Lake to Polk Street by 107 flame-arc lamps of the type developed by the General Electric Company for the city street lighting of Chicago. The Dearborn Street

installation is being erected by the Dearborn Street Improvement Association, an organization of merchants and property owners represented by Mr. Herbert A. Seward, Fisher Building, engineer. Each trolley pole on Dearborn Street within the lighting district will carry one of the lamps, which will be hung at a height of 25 ft. above the street level. Other lamps will be placed about the Dearborn Street station. Merchants' associations are also being organized to install similar private lighting on Clark Street and Wabash Avenue in the downtown district. Energy for the Dearborn Street lamps will be supplied by the Sanitary District of Chicago.

ILLUMINATION OF THE GRAND AVENUE VIADUCT, MILWAUKEE.

The new Grand Avenue viaduct at Milwaukee, Wis., stated to be the largest concrete viaduct in the world, has some interesting features in its illumination, as designed by Vaughan & Meyer, consulting engineers, Milwaukee. The length of this viaduct is 2088 ft. It was erected for the purpose of carrying Grand Avenue, one of the principal streets in Milwaukee, directly across the Menominee Valley. The viaduct is 80 ft. above the river and 67 ft. wide over all, with a 40-ft. roadway and two 10-ft. walls. The total cost was over $500,000.

For the illumination of this viaduct the bronze post shown in Fig. 2 was designed. A concrete base for the post was cast as a part of the viaduct railing, and on this the bronze post with its three lamps is placed. The central lamp fixture is approximately 18 in. in diameter, and the two smaller are about 14 in. in diameter.

The novel feature of these fixtures is that they have the general appearance of globes but are in reality reflectors. The upper half contains a large tungsten lamp covered with a prismatic reflector developed specially by the engineer for this work. This reflector is protected from dust from above by a white opalescent glass envelope or hemisphere. The bottom of the hemisphere is open without inclosing glassware, and the light which reaches the eye comes largely from the interior surface of the prismatic reflector. The depth is such as to shield the eye from the direct rays of the filament.

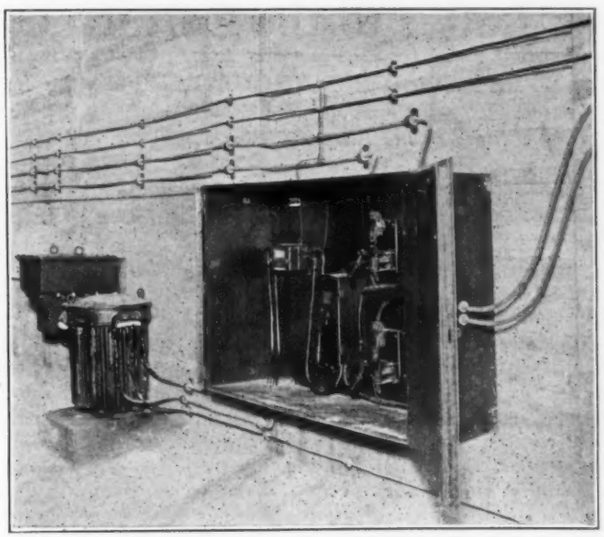


Fig. 1—Transformer Station, Milwaukee Viaduct.

The general arrangement of the lighting units is such that the ends of each span are marked by a double pair of posts, while there is a single pair in the middle. This applies to the central portion of the viaduct. The ends have single pairs of posts spaced from 75 ft. to 85 ft. apart. The wiring of the viaduct is with lead-covered cable in ducts in the bridge structure. Near the center of the bridge is a transformer station which receives electrical energy from the lighting company and distributes it to the bridge circuits. Fig. 2 gives a view of the transformer station. Fig. 3 shows the general scheme of connections of this station or center of distribution. It will be noticed that an Anderson time switch is included in the secondary wiring equipment for the purpose of turning lamps on and off according to a regular schedule.

Fig. 2—Lamp Standard for Grand Avenue Viaduct, Milwaukee.

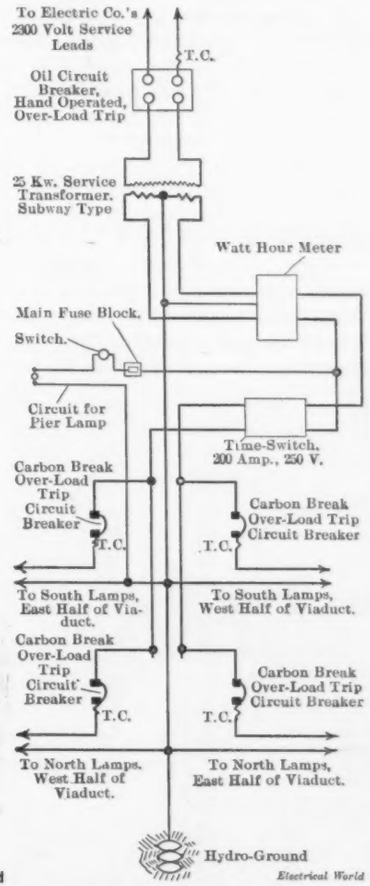

To Electric Co.'s 2300 Volt Service Leads
T.C.
Oil Circuit Breaker, Hand Operated, Over-Load Trip
25 Kw. Service Transformer, Subway Type
Watt Hour Meter
Main Fuse Block.
Switch.
Circuit for Pier Lamp
Time-Switch, 200 Amp., 250 V.
Carbon Break Over-Load Trip Circuit Breaker
T.C.
Carbon Break Over-Load Trip Circuit Breaker
T.C.
To South Lamps, East Half of Viaduct.
To South Lamps, West Half of Viaduct.
Carbon Break Over-Load Trip Circuit Breaker
T.C.
Carbon Break Over-Load Trip Circuit Breaker
T.C.
To North Lamps, West Half of Viaduct.
To North Lamps, East Half of Viaduct.
Hydro-Ground
Electrical World

Fig. 3—Diagram of Connections for Center Distribution.

Starting from the source of supply of electrical energy, the electrical installation consists of the following: On the high-voltage side is one 2300-volt lead-covered, two-conductor cable installed in one of the ducts under the sidewalk and connecting with the central-station company's cables at the east end of the viaduct. The 2300-volt cable terminates in an oil-circuit breaker at the transformer station in Pier No. 7. In this same pier is the watt-hour meter, time switch and four carbon circuit-breakers. These four circuit-breakers control the feeder cables which supply energy to the north and south sides of the east and west ends of the viaduct. The fifth circuit supplies energy to the lamps within the pier.

One interesting feature of this installation is the use of a bare copper wire neutral, which can be seen under the cabinet box in Fig. 2 and which forms a continuous unfused conductor.

It is intended that the time switch shall be set weekly according to a printed schedule. Full instructions have been prepared by the consulting engineers covering all points likely to arise in the operation of the electrical circuits and care of lamps.

From the foregoing description it will be seen that this installation is of considerable electrical interest, aside from the fact that it happens to be the lighting installation for the largest concrete viaduct in the world. The artistic part of the post design is the result of work done under the supervision of Mr. A. D. Koch, of H. C. Koch & Sons, architects, and his associates in the Municipal Art Committee appointed by the Milwaukee Art Society. The other members of the committee were Messrs. George Raab, curator of the Layton Art Gallery; Alexander Mueller, director of the Art Students' League, and W. H. Schuchardt, president of the Wisconsin Chapter of the American Institute of Architects.

ORNAMENTAL STREET LIGHTING AT JONESBORO, ARK.

The possibilities which "white-way" lighting offers to the central station, especially in small communities, are well illustrated in the case of Jonesboro, Ark., which owes its system of ornamental street illumination to its aggressive central-station manager, who, single-handed, secured contracts with abutting merchants for pro-rata shares of the cost of erecting and operating the complete system. The present installation comprises a total of nine blocks in length, extending up Main Street and around the court house square. Two years ago, when the city widened its sidewalks, requiring the resetting of all poles, some street-railway agitation arose, and the local manager had the foresight to suggest to the City Council that all telegraph and electric-lighting poles be placed directly opposite each other on the business streets. The new ornamental posts were accordingly later located in opposite pairs, between the poles referred to.

Fig. 1—White Way at Jonesboro, Ark.

Fifteen-foot four-arm Riverside poles are used, each carrying four 60-watt tungsten lamps inclosed in 12-in. Alba globes. The lamps are 10 ft. 7 in. above the sidewalk and measure 40 in. center to center. The posts have 14-in. bases and each standard weighs 525 lb. As shown in the illustration, all wiring is overhead. The leads are dropped from the nearest pole and attached to the two-pin arms on the 3-ft. post extension, thence down through the center to the distributing arms. The lamps are fed with energy from two circuits, one of which is of sufficiently heavy copper to supply energy also to electric signs when required, and is switched off at the plant at 11 o'clock each night. The other circuit is for the all-night post lamps. This circuit replaces seven 660-watt street arc lamps totaling 4620 watts, with an after-11-o'clock load of 5760 watts which is taken care of by connecting each circuit to an alternate post on each side of the street. An exception is made, however, of four posts on the square, the lamps on which operate all night. Replacement was made throughout other streets of Jonesboro of fifty-two

Fig. 2—White Way Lighting at Jonesboro, Ark.

660-watt street arc lamps, totaling 34,320 watts, with 151 128-watt series tungsten lamps, totaling 19,328 watts, thus affording a saving of 14,992 watts.

The occasion of opening of the White Way was made a general holiday at Jonesboro, and billed as such throughout the neighboring territory by the local business men's league. Prizes were offered for competitive drills by the local uniformed lodges, military organizations, etc. A grand street parade was also a feature of the occasion and added to the popular enthusiasm.

The original estimate of the cost of this construction, which covers a business frontage of 5205 ft., was $3,250, but the work was actually completed with a saving of $125 below the estimated amount, making the pro-rata cost per front foot 60 cents. The manager of the Jonesboro municipal plant, Mr. J. F. Christy, is vice-president of the Arkansas Public Utilities Association.

Letter to the Editors

RATES FOR ELECTRICAL ENERGY.

To the Editors of the Electrical World:

Sirs:—Perhaps there are as many solutions to the problem of rate determination as there are persons to attempt to find solutions. However, the writer believes that there is one class of solution that will meet with the approval of practically every one interested in the problem. This solution ignores entirely the use to which the energy is put but considers fully the time of consumption.

The object in distinguishing between a motor load and a lamp load and allowing a cheaper rate for the former is merely to recognize the fact that the lamp load occurs during the peak of the station load at night, while the motor load continues throughout the day and seldom overlaps the night peak. The cost of producing a kilowatt-hour varies according to the time of day or night, but is the same whether used for motor, lighting or heating service. It is evident, therefore, that any logical system of rate determination must be based on a variation of the rate throughout the hours of service. The production of a reliable meter providing a variation in rate of registration during the peak and non-peak hours would represent a thoroughly satisfactory solution of the rate-determination problem for all time to come.

Louisville, Ky. William McDonald.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Frequency Changer.—A note on a recent British patent (No. 8853, Aug. 1, 1912) of A. M. Taylor. In each phase of a three-phase circuit is inserted a choking coil with a highly saturated core, in series with a transformer with an unsaturated core, two current impulses being produced in the secondary each half period. The duration of each impulse is only one-third or less of the period of the fundamental half-wave of emf, but the amplitude may be whatever desired. By combining three or a multiple of three such transformers equivalent impulses of current are obtained. The secondaries of the transformers are connected in series, or they may be combined into one, whereby the iron volume is reduced. The transformers being connected across the phases, the emfs in the secondaries differ by 120 deg. and cancel out, leaving the third and higher harmonies only. The secondary of the triple frequency transformer is wound in four parts. One is connected to one phase of the high-frequency circuit to be supplied; another is connected in series with a reactance coil, which causes the current to lag 60 deg., and the free terminals are connected in the reverse sense to the next phase; the remaining two feed the primary of another transformer, one direct and the other through an impedance coil causing a current lag of 60 deg. The secondary supplies the third phase.—London *Elec. Eng'ing*, Aug. 8, 1912.

Parallel Operation of Alternators.—CARL CZEIJA.—A French translation of his recent German paper on the principal factors which are of importance in the parallel operation of alternators. He discusses the choice of the moment of inertia, the requirements which must be fulfilled by the prime movers and means for improving parallel operation. —*La Revue Elec.*, July 26, 1912.

Regulation of Alternating-Current Generators.—A note on a recent British patent (No. 22,757 of Aug. 1, 1912) of Siemens Brothers' Dynamo Works, Ltd. (F. E. M. Thrupp). A secondary exciter is driven by an alternating-current commutator motor, the speed of which depends on the magnitude and power-factor of the generator load. The stator of the motor is fed by a series transformer and the rotor direct from the mains. The field of the secondary exciter has an auxiliary winding in parallel with the alternator main field.—London *Elec. Eng'ing*, Aug. 8, 1912.

Shunt and Series Direct-Current Motors.—E. COHEN.—A mathematical note on the speed relation between shunt motors and series motors for direct current, and the transformation of a shunt motor into a series motor.—*Bull. trim. de l'Ass'n amicale des Anciens Elèves de l'École prat. d'Élec. ind.*, May, 1912; *La Revue Elec.*, July 26, 1912.

Commutation.—C. L. R. E. MENGES.—The author criticises some views concerning the theory of commutation expressed by Arnold and Lamme among others. He emphasizes that the neutrality of the zone of commutation forms the fundamental idea of the commutation theory as now generally accepted. In order to start a detailed discussion, he challenges Latour to express his views of some important details of the commutation theory.—*La Lumière Elec.*, Aug. 10, 1912.

Lamps and Lighting.

Train Lighting.—P. AMSLER.—A description of a new system of electric train lighting used by Brown, Boveri & Company. It allows the use of low lamp voltages, independently of the high overhead voltage. The generating unit consists of two machines. One of these is a motor, which takes the whole applied voltage and has two commutators and two armatures, which are joined in series; the other is a generator which can be wound so as to generate any required pressure, say between 30 volts and 50 volts, and thus permits the use of metallic filament lamps all connected in parallel. At voltages of this order metallic filaments are sufficiently strong to withstand the vibration of railway traffic. The generating unit must have a nearly constant speed, which requires a shunt-wound motor. Machines of small outputs, say, for 1.6 kw, if operated on 1200 volts, cannot be shunt-wound because this would mean too thin a gage of wire. This can be overcome by connecting the magnet windings in shunt with the terminals of the generator, since, if motor and generator are rigidly connected together, the requisite characteristics of a shunt-wound motor can obviously be obtained. A number of machines have been constructed on this system, the motors having a capacity of about 2 hp at 2000 r.p.m. The connections are shown in Fig. 1. Besides the above-mentioned

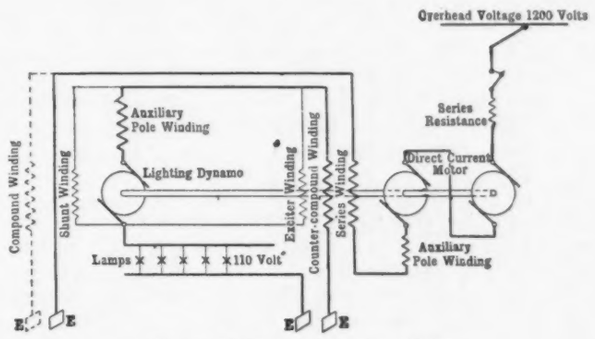


Fig. 1—Diagram of Connections.

exciter winding the magnets have a small series winding which starts the motor; otherwise, with the generator at rest, there would be no voltage at the terminals of the shunt winding. In order that this series winding should have no effect on the speed of the motor there is a compensating winding in the opposite direction which carries the main current of the generator. Both currents, therefore, are nearly proportional to the load on the generator and tend to neutralize one another as soon as the machine starts, the result being that the motor has a genuine shunt characteristic. The series windings on the motor are on the earthed side so that only the armature windings are really exposed to the high pressure, and even in case of short-circuits the high pressure cannot reach the lamps.—London *Electrician*, Aug. 16, 1912.

Flame-Arc Lamp.—PASSAVANT.—A note on a paper read before the German Association of Central Stations on a new flame-arc lamp with a specially long life for street lighting. The supply of oxygen-containing air to the arc is reduced. This design is due to Livio Carbone, whose patents were bought by the Allgemeine Elektricitäts Gesellschaft. The special feature is "the form of the carbon, which is divided into two zones, the upper zone being hot and the lower zone cool." After success was obtained in making electrodes whose combustion products do not attack the glass, the lamp was introduced by the Berlin Electricity Works, which are making extended experiments with it. While the conclusions already obtained are very favorable, definite results can be given only after continued use of the lamps in practice.—*Elek. Zeit.*, Aug. 8, 1912.

Generation, Transmission and Distribution.

Peat for Power Purposes.—H. V. TEGG.—A paper read at the Belfast meeting of the British Institution of Mechan-

ical Engineers. The author gives the results obtained in a commercial plant in Great Britain in which peat is used for the generation of power, the plant having been in operation since last September. Last October it was subjected to a test run of six hours' duration with a load of 250 bhp, the peat consumption per bhp-hour averaging 2.55 lb., while the peat fuel contained 18.98 per cent of water. This was with both producers running, although the load was considerably below the total capacity of the plant. Figures on the cost of fuel when running the factory either on coal or on peat are $155 for coal and $84 for peat per week, allowance being made in the last figure for extra labor.—London *Electrician*, Aug. 9, 1912.

Steam Turbines and Diesel Engines.—Gercke.—A note on a paper read before the German Association of Central Stations. The author sketched the progress in the development of these two types of prime movers and concluded that the Diesel engine is superior for smaller capacities, while, especially with a small load-factor and a low fuel cost, the steam turbine is greatly superior to the Diesel engine for larger capacities. In the discussion Snechting emphasized the considerably higher first cost of the Diesel engine. In Bremen a large Diesel engine plant is to be placed in operation because for special reasons it was desirable to have prime movers which could very quickly be started.—*Elek. Zeit.*, Aug. 8, 1912.

Ecuador.—A long illustrated description of the Guayaquil water-power plant in Ecuador. The plant contains three 860-kva, 800-volt, three-phase generators.—*La Lumière Elec.*, Aug. 10, 1912.

Traction.

Railway Convention.—A report of the seventeenth congress of the International Street Railway and Light Railway Association held in Christiania, Norway, from July 2 to July 5. The attendance was 500. Busse discussed rail corrugation, Buschbaum the German regulations for stray currents from the rails, Kühles various commercial questions of street rail systems; Scott-Hensen described in a paper the new Rjukan power plant, which is the largest water-power station of Norway. When complete 250,000 hp will be available. Various extended excursions were made.—*Elek. Zeit.*, Aug. 8, 1912.

Interpole Motors.—L. Bacqueyrisse.—A report presented before the congress of the International Street Railway and Light Railway Association in Christiania, Norway, on the results obtained in practice with interpole motors for traction. Notes are given on the arrangement of the commutation poles, the power and weight of the motors, the effect which the use of interpoles has had on the increase of voltage, on sparking of the commutator and maintenance of the commutator and brushes, on speed regulation by reduction of the field strength and on braking arrangements.—*La Revue Elec.*, July 26, 1912.

Car Mileage.—W. Wykes.—The author suggests an alteration in the method of calculating car mileage. He proposes, in the first instance, to reduce all the mileage to flat miles and then to work out the cost per passenger carried per mile and to use the result thus arrived at as a basis of comparison with other tramways.—London *Elec. Review*, Aug. 2, 1912.

Electric Mining Locomotives.—G. W. Hamilton.—The author discusses the importance of detailed information covering operating conditions in mines, especially the maximum output handled over maximum grades and distances during the working hours of the day, and shows how these details control the design of the locomotive.—*Elec. Journal*, August, 1912.

German Interurban Tramway System.—R. Krueger.—The first part of an illustrated statistical article on the system of electric tramways in and around Cologne.—*Elek Zeit.*, Aug. 1, 1912.

Hamburg.—G. Cuvillier.—The conclusion of his long illustrated article on the equipment of the Metropolitan Railway in Hamburg, Germany.—*La Lumière Elec.*, Aug. 3, 1912.

Brazil.—L. Wiener.—A review of electric traction in Brazil.—*Revue Gen. des Chemins de Fer et des Tramways*, Nov., 1911; *La Revue Elec.*, July 26, 1912.

Installations, Systems and Appliances.

Starting Resistances and Motor Fuses.—Erich Jasse.—In the first part of his article, which is illustrated by numerous diagrams, the author describes how to calculate the different steps of a starting resistance and the cross-section of the copper required in each step in order to prevent overheating and yet not waste metal. The author gives formulas for use in practice for calculating the dimensions of the conductors in starting resistances. He shows that the size of the starting resistance depends essentially only on the momentum of inertia of the masses which are to be accelerated and upon the ratio of the starting current to the stationary current. In the second part of the article the author deals with the protection of motors by means of fuses. If a motor which will be started without a special starting resistance is protected by means of a fuse the dimensions of the fuse should be calculated from the continuous load current of the motor, and a formula is given for the "time constant" of the fuse.—*Elek. u. Masch.* (Vienna), Aug. 11 and 18, 1912.

Combined Central Heating and Electric Plants.—E. D. Dreyfus.—A paper read before the National District Heating Association at Detroit. The author discusses the general equipment of combined central heating and electric plants and especially the use of automatic bleeder turbines and gives working results obtained in such plants together with a series of typical load curves.—*Elec. Journal*, August, 1912.

Electricity in Agriculture.—P. Lecler.—An illustrated report to the Association of French Central Stations on the results obtained in the application of electricity in agriculture and on possibilities of improvement.—*La Revue Elec.*, July 26, 1912.

Switches for Heating and Cooking Appliances.—W. P. Maycock.—A fully illustrated article on tumbler-switch controls for heating and cooking appliances.—London *Elec. Review*, Aug. 2, 1912.

Wires, Wiring and Conduits.

Calculation of Insulation Covering.—A. Michard.—The author first develops the fundamental formulas for calculating the insulating covering required on a wire from the viewpoints both of insulation and electrostatic rigidity. The formulas derived are illustrated by diagrams and applied to several numerical examples.—*La Revue Elec.*, July 26, 1912.

Electrophysics and Magnetism.

The Photoelectric Effect of Phosphorescent Material.—Chester A. Butman.—An account of an experimental investigation the chief results of which are as follows: Photoelectric fatigue and recovery is an inherent property of the material and is due solely to the incident light. High positive voltages accelerate fatigue with light. The velocities of the electrons ejected are dependent on the photoelectric state of the material. The saturation value is dependent on the photoelectric state of the material. No photoelectric effect can be obtained with Lenard's CaBiNa material with a wave-length longer than about 4100 angstrom units. Sulphur is photoelectric with light of a longer wave-length than 3200 angstrom units.—*Amer. Jour. of Science*, August, 1912.

Asymmetry in the Distribution of Secondary Cathode Rays Produced by X-Rays, and Its Dependence on the Penetrating Power of the Exciting Rays.—C. D. Cooksey.—An account of an experimental investigation in which

the ratio of emergence to incidence cathode rays produced in gold and silver by beams of fluorescent secondary X-rays was measured with the object of finding the dependence of the ratio on the penetrating power of the exciting rays. The fluorescent secondary X-rays from tin, zinc, iron and chromium were used as exciting rays, representing an increase in absorbability as measured in aluminum of about 8000 per cent between tin and chromium. After allowing for the absorption of the exciting rays in the layer of the metal from which the cathode rays come and in the air of the ionization chamber it was found that there was no definite variation in the ratio of emergence to incidence effect.—*Phil. Mag.*, July, 1912.

Radium C.—A. S. RUSSELL.—An account of an experimental investigation on the volatility of radium C. In presence of oxygen, radium A, radium B and radium C are all non-volatile from a surface of quartz below 700 deg.; the volatilization point of radium C is higher than 1200 deg. In presence of hydrogen radium A, radium B and radium C are completely volatile from a quartz surface below 650 deg. The volatilization point of radium C is about 360 deg.—*Phil. Mag.*, July, 1912.

Electrochemistry and Batteries.

Electrolytic Hypochlorite Solutions for Disinfection.—A note on the annual report for the year 1911 of Dr. F. W. Alexander, medical officer of health for the Metropolitan Borough of Poplar, which contains details regarding the employment of electrolytic hypochlorite disinfecting fluid. There were 53,063 gal. used during the year, being manufactured at a total cost of about $640. Since the plant has been installed, a period of about six years, nearly 200,000 gal. of fluid has been manufactured at a cost for energy and materials of less than $1,900. Not only are the Public Health Department and the various institutions of the Council (the public baths, etc.) furnished with the disinfectant, but the managers of the sick asylums and the Board of Guardians are supplied with an unlimited quantity free. For the fluid supplied to the works department a charge of 2 cents per gallon is made. The Public Health Department is credited with this amount, although no actual monetary transaction takes place. As applicants now usually bring their own receptacles to the depot, there is also a very appreciable saving in the expense on bottles alone. A total of 3494 gal. was supplied to the London County Council for use in cleaning the floors of school classrooms, while 7560 gal. were used in the public baths. In reply to adverse criticisms Dr. Alexander points out that after six years' experience he is convinced that there is no more suitable means than the electrolytic process of producing a cheap, clean and effective chlorine solution, and that such a solution is cheaper and more convenient than one of phenol.—London *Electrician*, Aug. 16, 1912.

Units, Measurements and Instruments.

Reichanstalt.—An account of the work of the German Reichanstalt during the year 1911. Some of the especially interesting results mentioned are or will be given elsewhere in the *Digest.*—*Elek. Zeit.*, Aug. 15, 1912.

Measuring Small Inductances.—S. BUTTERWORTH.—This paper describes a method of measuring inductance in which a single condenser may be used for all values of the self-induction. Results are given showing the accuracy that may be expected in the case of inductances of the order of a few microhenries. A self-induction may be measured in terms of a capacity by the method of Maxwell. The inductance is placed in the fourth arm of a balanced Wheatstone bridge (Fig. 2) and a condenser of capacity K is placed in parallel with the conjugate arm Q. The bridge will be balanced for variable currents, provided that $L/K = RQ = SP$, where L is the self-induction of the arm R. Unless the condenser can be varied continuously this method is tedious in operation. The following modifications have, therefore, been proposed: (*a*) If $L/K > RQ$, move the contact a along the battery arm. If V is the resistance intercepted between a and A, balance is attained when $QL/K = S\,[V\,(P+Q)+PQ]$. (*b*) If $L/K < RQ$, move the contact b along the S arm. If U is the resistance intercepted between b and B, balance is attained when $QL/K = P\,(Q+U)\,(S-U)$. The

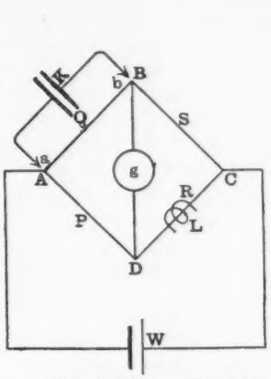


Fig. 2—Maxwell's Bridge.

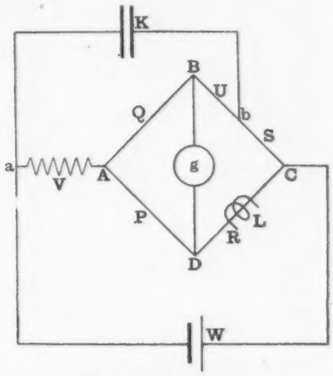


Fig. 3—Modified Bridge.

former method (*a*) is the more useful because the adjustment of V can be made without disturbing the steady current balance. Method (*b*) requires a slide wire in the arm S for rapid working. In order to avoid this the author has employed a combination of both methods. This is shown in Fig. 3. With the notation of this figure the conditions for balance are $RQ = P\,(U+S)$ and $QL/K = S\,[V\,(P+Q)+P\,(Q+U)]$. By a proper choice of S a self-induction may be measured with a single condenser. Also by adjusting V the inductive balance may be made independently of the resistance balance.—London *Electrician*, Aug. 16, 1912.

Loading Large Alternators.—F. D. NEWBURY.—A discussion of the following three methods of loading large alternators devised to approximate actual load conditions: (1) Separate open-circuit and short-circuit tests; (2) zero power-factor tests, and (3) the so-called direct-current open-delta test in which the field winding is excited to generate the full-load core losses (as nearly as these can be approximated on open circuit) and the armature winding is connected in delta with one corner open, through which direct current is introduced. Of these three methods the zero power-factor method more nearly approaches actual load conditions and the results will be, if anything, unfavorable to the apparatus. This is particularly true of the field-winding temperature, but this temperature can easily be reduced to the guaranteed condition in proportion to the losses. The direct-current open-delta method of loading gives results very closely approximating actual load conditions, but the results will, if anything, be favorable to the generator. The armature-winding temperature will be slightly lower than under actual load conditions and the field-winding temperature will be considerably below that corresponding to the maximum operating conditions. Accurate correction can be made for the field-winding temperature, but no satisfactory correction can be made for the armature-winding temperature. The short-circuit and open-circuit method of loading gives satisfactory results with machines having satisfactory air circulation, but this method will not directly detect faulty design in this respect. The results will, however, indicate such defect indirectly and the method may be used when neither of the other methods is feasible.—*Electric Journal*, August, 1912.

Induction Meter.—An official publication by the Reichsanstalt admitting for calibration the single-phase induction meter of H. Perpipersberg. The construction of the meter and its method of operation are described and illustrated.—*Elek. Zeit.*, Aug. 8, 1912.

Measuring High Speeds.—J. Schillo.—An English translation of his recent German paper on the stroboscope in the determination of high speeds of rotation.—London *Electrician,* Aug. 9, 1912.

Telegraphy, Telephony and Signals.

Low-Frequency Circuit in Spark Telegraphy.—L. B. Turner.—A long paper illustrated by diagrams in which the low-frequency electrical relations in a wireless transmitter operating on the spark system are investigated, with special reference to musical note transmitters. The case for the adoption of a musical note is first outlined. Permissible assumptions for simplifying the treatment of the transformer circuits are established and the operation with resonance adjustment is fully analyzed. Calculations are made for a 10-kw musical transmitter illustrating the quantitative results arrived at.—London *Electrician,* Aug. 2, 1912.

Disturbances in Telephone Lines Due to Single-Phase Railroads.—Georg Stein.—An article illustrated by diagrams in which the author gives a formula for calculating the currents induced in a telephone line which runs parallel to a single-phase traction system. The author discusses the means for overcoming the disturbing noises in the telephone. The first is careful crossing of the two telephone wires with respect to each other, in order to make the capacity of the two wires with respect to the railway wire as nearly equal as possible. A second means is the use of a discharge coil with some hundreds of ohms resistance between telephone line and earth, in order to overcome the effect of the fluctuations in the insulation resistance of the two telephone wires. A third means is equalization of the resistances of the two telephone wires. Finally the author discusses the production of high voltages in a telephone line due to a short-circuit of the single-phase railway.—*Elek. Zeit.,* Aug. 15, 1912.

The Effect of the Atmosphere on Wireless-Telegraph Transmitters and Receivers.—A. Esau.—By experiments with the damping effect on antennas the author shows that the damping varies under the influence of the atmosphere. With respect to the effect on damping the atmospheric influences may be divided into two groups—first, irregular effects due to rain or snow which may cause variations up to 200 per cent, and, second, effects which occur with great regularity, but which are much less in intensity, causing variations up to 20 per cent only. The second effect is different in summer and in winter.—*Phys. Zeit.,* Aug. 1, 1912.

Radiation Efficiency of Wireless Transmitters.—L. B. Turner.—A note criticising two points in the recent paper of Erskine-Murray on a method of measuring the power lost in and the power radiated by a transmitting antenna.—London *Electrician,* July 26, 1912. J. Erskine Murray replies to these criticisms in detail in London *Electrician,* Aug. 2, 1912. A further reply by Turner in London *Electrician,* Aug. 9, 1912.

Miscellaneous.

Central-Station Convention.—Eswein.—A report of the twenty-first general meeting of the Association of German Central Stations, held from June 11 to June 14, 1912, in Kiel. The attendance was 340. In his presidential address Meng emphasized that the chief functions of central-station managers are now of commercial rather than technical character. He mentioned the advantages of exhibitions illustrating the various applications of electricity and of an extended advertising propaganda. The modern principles employed by commercial business houses should also be in use in central stations. Too many regulations by the government are a great obstacle to the development of the industry. The safety rules which have been formulated for the electrical industries have unfortunately produced the idea that electricity is in itself very dangerous. Gercke read a paper on the recent development of steam turbines and Diesel engines. Schroeter read a paper on the Neon lamp, Grossmann a paper on electrolytic stia meters, Wilkens a paper on mechanical stokers, Besag a paper on automatic parallel connection and synchronizing. Various reports of committees were presented. Schlebach reported on the results of tests with gas lamps and electric arc lamps in certain streets of Karlsruhe, where it was shown that arc lamps produced a very uniform and superior illumination of the sidewalks. Tillmetz discussed the use of refuse destructors in connection with central stations. Passavant spoke on new flame-arc lamps with a longer life of the carbons, Scherbius on the speed regulation of three-phase motors, Auhagen on the use of electricity aboard ship, Warrelmann on fuses and protective devices, Frank on protection of networks against lightning and dangerously high voltages, and Mahr and Wilkens on force versus natural draft.—*Elek. Zeit.,* Aug. 8, 1912.

Definitions.—A further account of a report of the British electrotechnical committee giving the second instalment of definitions adopted. Among them are the following: Admittance is the reciprocal of impedance, the quotient obtained by dividing the current in a conductor by the emf which produces it. The conductance of a conductor is the quotient of the current divided by the potential difference between the terminals of the conductor, usually expressed in mhos. Direct current is a term not recommended. Efficiency is (1) in the case of generators, motors, converters or transformers the ratio of the total output to the total input (for instance, in case of a separately excited synchronous generator the excitation power should be added to the power received at the shaft); (2) in the case of accumulators efficiency is (a) the ratio of the amount of energy available during the discharge to the amount of energy required during the charge (watt-hours) and (b) the ratio of the amount of current available during the discharge to the amount of current required during the charge (ampere-hours). A field magnet is defined as any permanent magnet or electromagnet employed for the purpose of providing a magnetic field. (It is incorrect to speak of the field magnets of a dynamo or motor as its fields; they should be called its magnets, if the term field magnets is too long).—London *Electrician,* Aug. 9, 1912.

Book Reviews

The Manual of the Railway Signal Association. By a committee consisting of Messrs. H. S. Balliet, C. C. Rosenberg and W. J. Eck, chairman. Published by the Association, Bethlehem, Pa., 1912.

A compilation of the findings, conclusions, standards and specifications of the Railway Signal Association. This loose-leaf manual is virtually a handbook on modern railway signal practice and of interest to signal engineers, signal officers and employees in signal departments, with steam and electric railways. The secretary of the association is Mr. C. C. Rosenberg, Bethlehem, Pa.

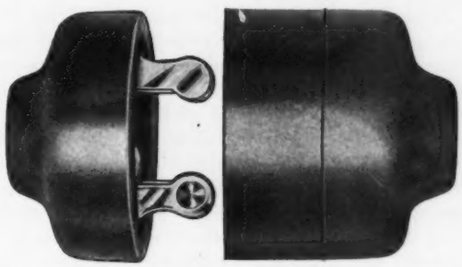
National Commercial Gas Association Proceedings, 1911. New York: 417 pages, 17 illus.

The bound volume of the proceedings of the seventh annual meeting of the National Commercial Gas Association held Oct. 24 to 26, 1911, at Denver, Col. The paper contained therein of most interest to electrical engineers is one on "Comparative Costs and Efficiency of Gas, Electric and Gasoline Lighting," by Mr. W. M. Blinks, of Kalamazoo, Mich. Another paper of more general interest is one on "Pensions and Profit Sharing," by Mr. J. B. Douglass, of Philadelphia, Pa. The discussions of the papers are included in the proceedings.

New Apparatus and Appliances

COMPOSITION CORD CONNECTOR.

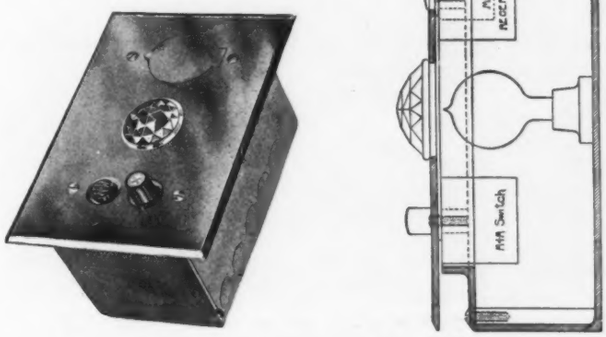
A black composition cord connector put on the market by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is shown in the accompanying illustration. The contacts lock firmly and yet are separated by a pull in any direction. The composition body is made of insulating material developed in the ceramic laboratory of the company. This material is eminently suited for such a device because it is tough and molds accurately.



Black Composition Cord Connector.

INDICATING SWITCH FOR HEATING AND COOKING APPLIANCES.

Owing to the convenience of their use, the sale of electrical heating and cooking appliances is steadily increasing. However, like all electrical apparatus, they must be correctly installed to insure the full benefit from their use. In this connection it is well to note the requirements of the National Board of Fire Underwriters. According to the National Electric Code, electric heaters must be protected by a cut-out and controlled by indicating switches; moreover, it is advisable to connect in multiple with the heater, and between it and the switch, a low-candle-power lamp. This arrangement is suggested to prevent the switch being left in circuit while the heater is not in use. For portable devices the flexible conductors must be connected to an approved plug and receptacle, the plug of which will be pulled out of the receptacle when an abnormal strain is put on the conductors.



Indicating Switch for Heating and Cooking Appliances.

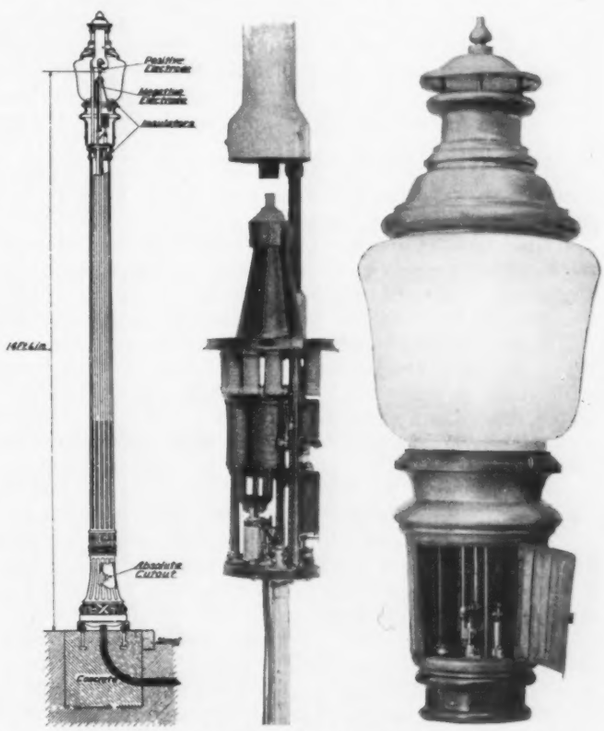
To meet the demand for a practical device which would meet the above requirements, the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., has placed upon the market indicating heater receptacles for installation in residences, laundries, factories, etc. For residences and similar installations use is made of switches rated at 5, 10, 20 and 25 amp respectively. The devices consist of a suitable switch, lamp and base receptacle and a flush plug and receptacle. The outfit is mounted in either a steel wall-case or cast-iron box and covered by a brass face-plate having a crystal or ruby cut-glass jewel inserted in it. In an installation of this kind it is advisable to run a separate circuit through from the panelboard, and hence no fuses are provided in the box.

For industrial installations, such as tailor shops and laundries, where no plug and receptacle are required, use is made of a specially designed box containing a cut-out, a switch and a lamp and base receptacle. The cut-out can be either of the cartridge or plug-fuse type, and the fuses become accessible by opening the door provided.

LUMINOUS-ARC LIGHTING IN UTICA, N. Y.

An initial installation of sixty-six ornamental luminous-arc lamps has been placed along the business section of Genesee Street in the city of Utica. The opening of this "Great White Way" was one of the features of the celebration of "Utica Day" and the notification ceremonies when Vice-president James Schoolcraft Sherman was officially told of his renomination.

The city, gayly decorated for the occasion, was enshrouded in darkness at 7:30 o'clock on the night of Aug. 20, when Mayor Frank J. Baker touched the button which turned on the new arc lamps. Genesee Street was packed with pedestrians, automobiles and traffic, when suddenly the new arcs sprang into being and the entire street was flooded with an abundance of mellow white light, noticeable for the entire absence of dazzling points of flame and confusing shadows.



Figs. 1, 2 and 3—Details of Luminous-Arc Lamp.

The lighting of Genesee Street, of which the city may well be proud, is merely the beginning of a new system of ornamental street lighting which, when completed, will make Utica one of the best lighted cities in the country. Work is now in progress to illuminate the Parkway Boulevard, leading from upper Genesee Street to the new Roscoe

Fig. 4—Day View of Genesee Street, Utica, N. Y.

Conkling park. Sixteen new Parkway ornamental luminous-arc lamps, mounted on 18-ft. posts and equipped with special alabaster globes for wide-angle distribution, have already been ordered. The Parkway arc lamps will be set along alternate sides of the Boulevard and will be spaced about 475 ft. apart.

The new lighting system is also to be carried well up into the residential section along Genesee Street. Fourteen lamps will be placed on Bleecker Street to light that thoroughfare for three blocks east of Genesee Street. The ornamental illumination which now ends at Baggs Square will be carried to the depot and along the high bridge over the New York Central tracks. Sixteen lamps, similar to those installed on Genesee Street, will be placed along this bridge and its approaches.

The work of installing the new arc lamps along Genesee Street was completed just four weeks from the date that the order for the new lamps was placed with the General Electric Company and that for the poles with the Ornamental Lighting Company. A committee of the Chamber of Commerce, composed of Messrs. Thomas W. Johnson, John Slauson, Edward Martin, John J. Booth and John White, led the movement for better lighting, and soon all the business men along lower Genesee Street had expressed their willingness to contribute to the lighting fund. The estimated cost was approximately $2 a lineal foot frontage along the street for the lamps, the ornamental poles and the foundations. The Utica Gas & Electric Company agreed to connect the lamps at its own expense. Up to the first of next year the business men will also refund to the city all extra cost for energy in excess of the fund provided to maintain the old arc lamps which have been removed. After Jan. 1 the city will provide for the maintenance of all the arc lamps.

It is noticeable that the arc lamps, being mounted on the tops of specially designed bronze pillars, are equally ornamental by day and by night. The lamp is designed so that the mechanism is concealed within the casing of the lamp, which forms the top of the ornamental post, leaving nothing visible but the white globe and the top of the post. These pillars, standing at stated intervals on alternate sides of the street, add greatly to the general appearance of the thoroughfare.

The new lighting units are the General Electric 6.6 amp. direct-current series ornamental luminous-arc lamps, and they are operated from Brush arc generators which were already installed. Each lamp consumes 510 watts and will give approximately 1000 cp. These lamps are for ornamental street lighting, because the greatest intensity of light occurs about 10 deg. to 30 deg. below the horizontal plane of the lamp, giving a maximum amount of light over the entire street area and at the same time illuminating the adjacent buildings in detail even above the horizontal plane of the lamp itself. The light is always steady and constant throughout the length of the trim and there are no brilliant points of light to dazzle the eyes, owing to the fact that the light emanates from the large alabaster globe, which is completely filled with light, and at the same time makes the arc invisible to the eye, thus forming a secondary source of illumination.

The mechanism of the lamp itself is simple, being practically the same as that of the standard pendent types, over 100,000 of which are in use. In trimming only one electrode is affected and it is not necessary to remove the globe. The chimney and top ornament are merely raised and swung to one side so that the lower electrode can be pushed down into position. A cut-out, located in the base of the lamp, provides means for disconnecting the lamp for trimming. Globe breakage is reduced owing to the fact that the globe is some distance from the arc and that it does not require complete removal for cleansing purposes. The large amount of illumination available from these lamps makes it possible to space them further apart, requiring fewer lamps than other forms of ornamental street lighting.

It is a misnomer to call Utica's street-lighting system "ornamental" because it is more than that. It is, first and last, strictly a business proposition. Results have proved in other cities that well-lighted streets are an excellent asset to a city. They bring new business and new inhabitants, and on those nights when the business places are open there is no question that a well-lighted street makes more business for all.

The arc lamps are mounted on the top of ornamental iron columns, which were made in Utica, at the request of the Chamber of Commerce, by the Ornamental Lighting Pole Company, of New York City. These posts, fluted and bronzed, extend 14.5 ft. above the sidewalk. The base of each post is 1.5 ft. square, securely bolted to a concrete foundation, built flush with the sidewalk, and it tapers

Fig. 5—Night View of Genesee Street, Utica, N. Y.

gracefully toward the top. All connections are made in conduits so that the wiring is entirely concealed, a cable being laid along Genesee Street. The work was accomplished under the energetic direction of Mr. A. T. Throop, general manager of the electrical department of the Utica Gas & Electric Company.

SEMI-INDIRECT ILLUMINATION OF A MODERN RESTAURANT.

An installation of semi-indirect lighting representing an advance over much of the best recent practice has lately been placed in service at the Restaurant Du Pont, in the Boston shopping district. The establishment occupies quarters on the second floor of the new Lawrence Building, overlooking the Tremont Street mall, and caters to the most discriminating patronage. The lighting problem has been worked out with unusual care and the results are well indicated even in the accompanying reproduction from a negative exposed only to the normal evening illumination of the café.

The restaurant occupies an L-shaped area containing 4712 sq. ft., its extreme dimensions being about 146 ft. x 42 ft., with a ceiling 10.5 ft. in height. The ceiling is divided into panels, opposite which are wall recesses containing tapestried windows, the curtains being green and the ceiling white with a slight greenish tint. The café is provided with a mosaic-tile floor in which white insets predominate, although black, yellow and green pieces are used to a moderate extent to furnish the desired patterns for decoration. The seating capacity is 320, and the tables are provided with white cloths in every instance. The walls and columns are finished to a height of 6 ft. with walnut-colored wooden panels, the rest of the space being white with decorations in relief.

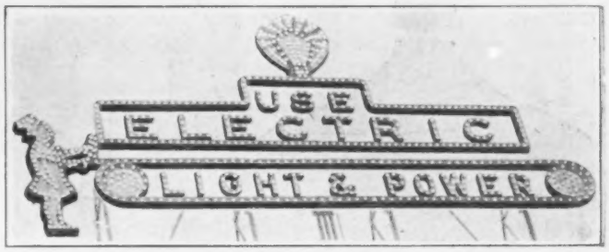
The fixtures in use are of the "X-ray, Eye-Comfort type," in which four 110-volt tungsten lamps placed in a reflecting bowl hung about 3 ft. below the ceiling provide the general illumination of the room by the indirect method, small, low-candle-power lamps being added to provide a warm glow of light through glass set into the bases of the fixtures for the purpose of satisfying the expectation by the eye of a visible source of light. The over-all diameter of this type of fixture is 24 in., each one being hung with the bottom about 7.5 ft. above the floor. Each standard fixture contains a present equipment of two 40-watt and two 60-watt wire-type tungsten lamps placed with their axes horizontal, two 8-cp lamps being provided for the soft direct illumination mentioned above. A three-way switch connected in the circuits of each fixture enables the lamp groups to be cut in or out as desired. Four of the fixtures at the distant end of the room, where the ell occupied is

Indirectly Illuminated Restaurant.

but 14 ft. wide, are now equipped with four 40-watt lamps each, with the usual smaller units for esthetic purposes. The fixtures are installed in three rows, the longest containing nine of them spaced at equal distances throughout the entire length of the establishment, the next containing six fixtures mounted in a row 18 ft. from the first, and the third, two fixtures 15 ft. from the second. There are no wall fixtures or candelabra except single decorative units of 8-cp rating, each mounted in a brown fabric shade on a silver standard, used on the outside tables. The energy requirements of the café total about 0.8 watt per square foot of floor area. Electrical service for the restaurant is furnished by the Edison Electric Illuminating Company of Boston, and the lighting installation was designed by the engineering department of the Pettingell-Andrews Company, Boston, Mass.

ELECTRIC ROOF SIGN.

The Sandusky Gas & Electric Company, Sandusky, Ohio, is advertising its service with a large electric roof sign built by the A. & W. Electric Sign Company, Cleveland, Ohio. This sign is 28 ft. long and 16½ ft. high, with letters



Electric Roof Sign.

ranging in height from 16 in. in the top row to 20 in. in the second row and 18 in. in the bottom row. The operation, by referring to the illustration, may be described as follows: First, the words "Use Electric Light and Power" appear, with the figure of the girl, who next throws a switch displaying the upper border and the lamp outline at the top. Then she turns another switch, starting in motion the belt and pulleys at the bottom, typifying electric power.

There are 190 lamps in the large lamp outline at the top, 180 lamps in the letters and 391 in the other features, all of the 5-watt, 11-volt tungsten-filament type. The Sandusky company has received numerous compliments on this sign and is very much gratified over the results. The design was worked out by the builders from suggestions contributed by Mr. E. A. Bechstein, manager of the Sandusky company.

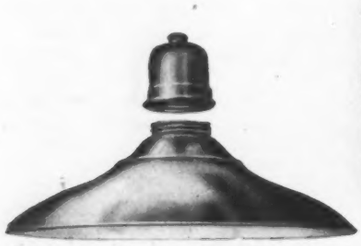
EXHIBITS AT MUNICIPAL ELECTRICIANS' CONVENTION.

A number of electrical manufacturers made exhibits at the Peoria convention of the International Association of Municipal Electricians on Aug. 27-29. Among them were the Frank Adam Electric Company, St. Louis, knife switches and panelboards; Central Electric Company, Chicago, Alexalite fixtures, insulated wires and supplies; Chicago Fuse Manufacturing Company, Chicago, fuses and fuse blocks; Detroit Fuse & Manufacturing Company, Detroit, iron-clad switches and alternating-current motor starters; Duplex Metals Company, Chester, Pa., copper-clad steel wire; Gamewell Fire Alarm Telegraph Company, New York, fire-alarm apparatus; H. W. Johns-Manville Company, New York, subway and service boxes, fuses and conduit; C. S. Knowles, Boston, wires, cables and specialties; W. N. Matthews & Brother, St. Louis, lamp guards and specialties; National Metal Molding Company, Pittsburgh, casings for exposed wiring; Nelite Works of General Electric Company, Fostoria, Ohio, electrical glassware; Pass & Seymour, Solvay, N. Y., wiring devices; Sprague Electric Works of General Electric Company, New York, interior conduit; Standard Underground Cable

Company, Pittsburgh, copper-clad and insulated wires. Representatives were also present from the Crouse-Hinds Company, Electrical Appliance Company, National India Rubber Company, National Quality Lamp Division of the General Electric Company, Okonite Company and Safety Wire & Cable Company.

REFLECTOR AND CANOPY.

The new lighting unit put on the market by the Wheeler Reflector Company, of Boston, Mass., consists of a porcelain-enameled steel canopy, or socket housing, with an inner copper screw ring. The reflector part of the unit has a threaded collar which engages with the screw ring in the canopy. This allows the reflector to be removed easily from the canopy for cleaning. Porcelain-enameled steel reflectors of the various kinds are made interchangeable.



Reflector and Canopy.

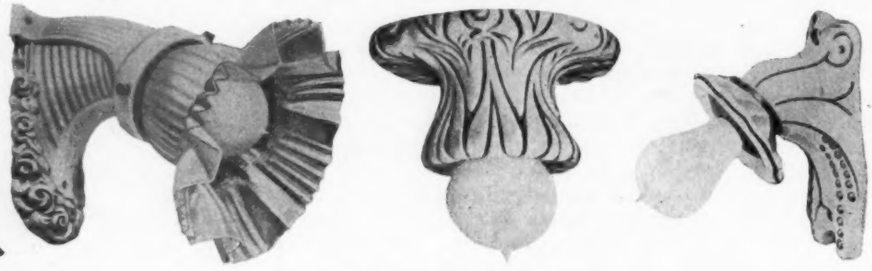
PORTABLE WATT-HOUR METER.

The Sangamo Electric Company, Springfield, Ill., has developed a line of portable meters illustrated herewith. The measuring elements are of the mercury flotation type used in the Sangamo electric-vehicle meters, thus securing immunity against damage by shocks or jars. The meters are all of the shunted type, so by the use of a few extra shunts a large range of measurements can be made with a single meter. A feature of the meter is a special reset dial operated with a key. After each test or run, the large dial is read and the hand set back to zero without in any way affecting the reading on the small dials, which therefore give a record of the total energy consumed. The use of this reset fast-moving register is of importance in securing records of energy consumed in comparatively short intervals of time. The entire mechanism is mounted in a substantial hard-wood polished carrying case.

Portable Watt-Hour Meter.

ORNAMENTAL RECEPTACLES.

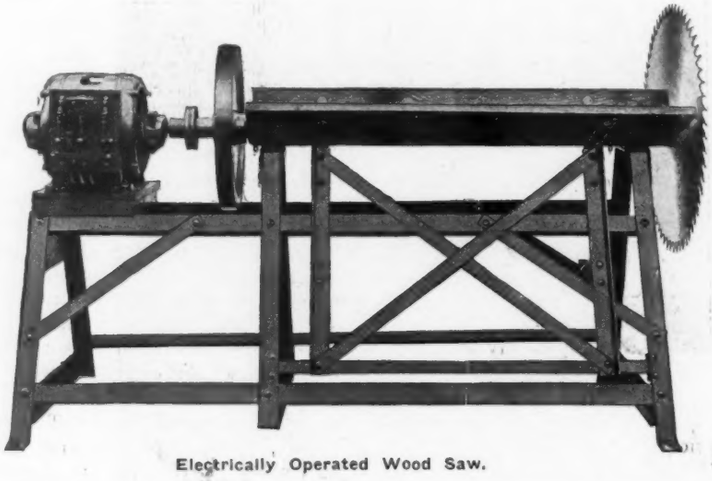
Ornamental chinaware receptacles of a type that has been in use abroad for several years are now being introduced in this country by the Murphy Lamp Company, of New York. These receptacles can be made in an infinite number of artistic designs and in any desired combination of colors, such as white and gold, delft patterns, etc. Any kind of incandescent lamp can be used in this type of receptacle, which can be furnished for ceiling or for wall use. The rigidity and strength of the chinaware afford protection for the socket against disturbance by vibration from any source, and its composition renders the receptacle impervious to moisture, corrosion or effects of dust or other foreign matter. Inasmuch as they can be made to conform to any desired style of architecture, these receptacles offer a means to the decorator of harmonizing the lighting features of a room with the general decorative plan. For enriching the decorations of banks, hotels, libraries, steamship saloons, public halls, railroad stations, etc., they afford the decorator a means of departing from the commonplace in the installation of lighting fixtures.



Ornamental Porcelain Receptacles.

ELECTRICALLY OPERATED WOOD SAW.

Illustrated herewith is a machine designed for sawing cordwood with the least amount of power consumption. As will be noted the motor is directly connected through flexible, insulated coupling to the saw, the shaft being provided with a heavy flywheel for relieving the motor from excessive momentary loads. It is stated that the equipment will saw a full cord of wood, four pieces to the stick, for each kilowatt-hour of energy consumed. The motor and saw are mounted on heavy steel angles braced and riveted so as to maintain rigidity. The equipment has been developed for the market by Fred W. Walter, 33 Atlantic Street, Norfolk, Va.



Electrically Operated Wood Saw.

ILLUMINATED ADVERTISING OF BOSTON, 1912.

Electric illumination is playing a prominent part in the preliminary advertising of the Boston 1912 Electric Show throughout eastern New England. Electrically lighted co-operative development signs and billboards have been utilized by the Edison Electric Illuminating Company of Boston at many strategic points in its territory, and at present practically all the railroad trunk lines entering Boston as well as important street railway routes are "covered" by forceful appeals in the form of electric signs which fall within the range of vision of all inbound and outbound travelers by day and night. The Boston & Albany lines are served by display lighting at South Framingham, Newton, Natick, Hopkinton, Holliston and Ashland; the New York, New Haven & Hartford travel is reached by a striking sign at Canton Junction, and the Boston & Maine traffic is appealed to at Arlington, Stoneham, Prospect Hill, Chelsea, Waltham and points near Swampscott and outside of Portsmouth, N. H. In general, these displays point out the time and place of the show, which is to be held in the Mechanics' Building, Boston, from Sept. 28 to Oct. 26; emphasize the unprecedented size and outlay involved, touch upon the number of operating exhibits to be shown, exceeding 10,000, and seek in as few words as possible to arouse interest in the rapidly approaching event, which will be the largest all-electric show ever held.

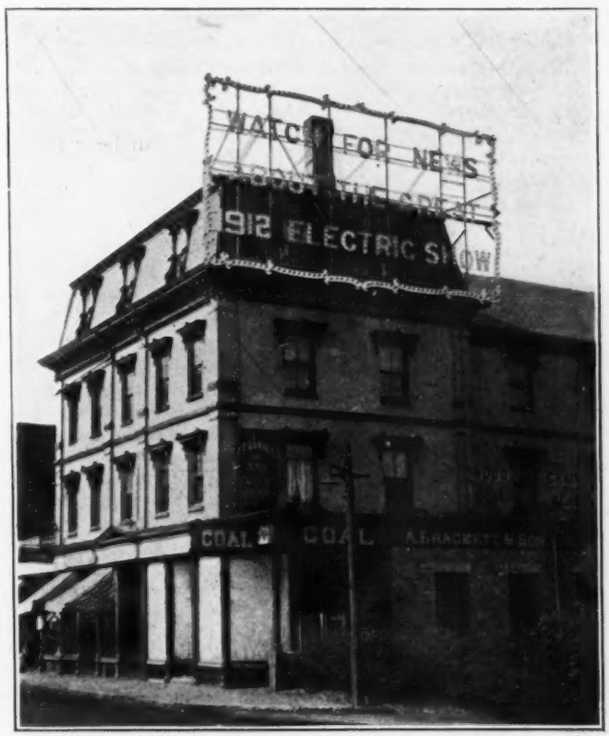


Fig. 1—Electric Sign at Newton, Mass., Advertising Boston Electric Show.

Fig. 2—Illuminated Billboard Used for Boston Electric Show Advertising.

The co-operative development signs employed are usually about 50 ft. long x 15 ft. high, and with the exception of those at Waltham (Linden Street) and Canton Junction, are equipped with trough reflectors. Where the location permits, the signs are built with double facing, the Natick board, for example, being situated between a steam railroad and an electric railway, so that an appeal to each class of traffic is made. This board is illuminated by 100 50-watt metallized-filament lamps, fifty similar lamps being used at South Framingham. At Chelsea a similar sign appeals to traffic passing over the Revere Beach Boulevard, 100 lamps being used on the two sides of the board. At Canton Junction a double-faced sign is in use, its dimensions being 50 ft. x 15 ft., the lighting being effected by ten fixtures on each side. Each fixture is equipped with a 125-watt (50-cp) lamp and individual reflector. A similar sign is in use at Linden Street, Waltham.

Besides the foregoing, about twenty electric signs ordinarily used by real estate dealers are in service in advertising the show. The company furnishes free energy and lamp renewals for these signs under normal conditions with the proviso that new buildings advertised shall be equipped with electric wiring and this fact featured. The real estate signs vary in size from 6 ft. x 8 ft. to 10 ft. x 25 ft. A typical sign, located on Commonwealth Avenue, Auburndale, is illustrated herewith. This sign is 20 ft. x 10 ft. in dimensions, and is equipped with six 100-watt tungsten lamps mounted in 6-in. x 8-in. x 11-in. reflectors attached to 1-in. pipe brackets and set with the lamps about 12 ft. above the ground, 30 in. from the front of the board and 3 ft. apart, the reflectors being set with axes making a downward angle of about 45 degrees, and painted with white enamel on their inside surfaces. All energy is supplied on a meter basis at 110 volts, coming either from the outside network or from a local transformer. Time switches are also provided in each instance.

The Newton and Waltham signs are two of the most striking on the Edison system, and each is of the flashing type, having dimensions about 22 ft. x 35 ft. The installations are both mounted on steel framing, upon the roofs of buildings close to railroad trunk lines. The Newton sign, illustrated herewith, contains 650 10-watt metallized filament lamps, and the Waltham sign contains 200 4-cp lamps and 500 2-cp lamps. Red borders are used on each, color caps being employed in the Newton sign and dipped lamps at Waltham. Each sign sets forth a line at a time until the message is complete, after which the entire display is cut off. Prior to the opening of the show these signs will be operated practically all night, every night.

Industrial and Financial News

DURING the past week the general situation has been marked by a sharp advance in money rates and a large decrease in the bank surplus, while the prospects of a shortage of freight cars are increasing. Call money rates rose to 4½ per cent and ninety-day funds have been quoted at 5 per cent. These conditions are explained, in part at least, by the extra demand for funds at the crop-moving season. The volume of business in the machinery trade is reported to be increasing month by month, and the market is particularly active in the Middle West. Bank clearings during the past week showed an increase in all of the five leading cities, with the exception of St. Louis.

The reports of business in the electrical industry continue to be encouraging, and steady progress seems to be the rule. New enterprises are going ahead and there are no inherent difficulties, apparently, in securing the necessary financing. The increasing importance of the political situation is commencing to influence somewhat the discussion of the business situation, particularly since the recent election in Vermont.

General Electric's Pension System.—The General Electric Company has recently announced an extensive pension system, under which it is planned to pension male employees who have been in the service of the company for twenty years or more and have reached the age of seventy years and female employees who have been with the company for a like period and have reached the age of sixty years. Employees may be pensioned if incapacitated for work after the ages of sixty-five for men and fifty-five for women. The pension will consist in all cases of 1 per cent of the average yearly rate for the ten years preceding the employee's retirement, multiplied by the number of years he has been employed; but no employee shall receive more than $125 per month. Some fifty employees at the Schenectady works will be pensioned this fall. The system will apply likewise to the Lynn, Pittsfield, New York, Fort Wayne and Harrison works and plants in other cities. The first pension board, which will serve for one year, is composed of E. W. Rice, Jr., chairman; Marsden L. Perry, F. C. Pratt, G. E. Emmons, W. C. Fish, G. F. Morrison, C. C. Chesney and M. F. Westover.

Third Avenue Railway Company Seeks to Purchase Securities of New York City Interborough Railway Company.—The Public Service Commission for the First District of New York has received from the Third Avenue Railway Company a petition asking consent for the purchase of 13,560 shares of the stock and $259,000 par value of the bonds of the New York City Interborough Railway Company for the sum of $234,625. The petition states that the Third Avenue Company now owns 28,650 shares of the stock and $1,413,000 par value of the bonds of the New York City Interborough Company. The latter has outstanding $5,000,000 in capital stock and an authorized bond issue of $5,000,000, of which $3,000,000 have been issued. Of the bonds issued, $87,000 belong to the sinking fund, $1,211,000 are in possession of the New York City Interborough Railway Company, and $1,702,000 are outstanding. A hearing will be held on the application next month.

Bay State Street Railway Company Notes.—The Bay State Street Railway Company, which owns and operates a comprehensive system of street-railway lines connecting the principal cities and towns situated within a distance of 30 miles north and 45 miles south of the city of Boston, including Lowell, Lynn, Lawrence, Haverhill, Salem, Gloucester, Quincy, Brockton and other cities, is disposing of an issue of $2,000,000 par value of 5 per cent coupon notes. These notes will mature serially from 1913 to 1932. The Bay State company controls a total of 956 miles of track, including 68 miles operated under lease in New Hampshire and Rhode Island and 26 miles in the city of Boston leased to the Boston Elevated Railway Company. This offering is being handled by N. W. Harris & Company, Marrill, Oldham & Company and Perry, Coffin & Burr. Approval of the issue has been secured from the Massachusetts Board of Railroad Commissioners.

Growth of Pacific Gas & Electric Company's Business.—The Pacific Gas & Electric Company's consumers increased 12,224 during the first six months of the current year, and on this basis it is estimated that at the end of 1912 there will be a total of 312,000 consumers, with an increase of nearly $1,000,000 in gross earnings. For 1911 the gross was $14,604,000 compared with $14,300,000 for 1910. The average gross earnings per customer amounted to $40 per annum during 1911. This average has been increasing steadily for several years, notwithstanding rate reductions in all large centers of consumption. Work on the new hydroelectric plant on the Bear River is said to be progressing rapidly, and it will probably be ready for operation during 1913. After this plant is placed in commission the company will no longer be required to purchase electrical energy, as it is now compelled to do.

Chicago Suburban Gas & Electric Company.—The Chicago Suburban Gas & Electric Company was incorporated under the laws of Delaware on Aug. 27, with authorized capital stock of $6,000,000. It will take over, through reorganization, the North Shore Gas Company, which has its headquarters in Waukegan, Ill., and supplies gas to that city and also to North Chicago, Lake Bluff, Lake Forest, Fort Sheridan, Highwood, Highland Park, Libertyville, Ravinia, Winnetka and Glencoe, Ill. Mr. Charles T. Boynton is president of the company and Mr. W. Irving Osborne is secretary and treasurer. The new company is not included in the Insull group of public-service properties, as has been reported.

Scranton Electric Company's Bonds.—An offering of $234,000 of the 5 per cent gold refunding bonds of the Scranton Electric Company, of Scranton, Pa., is being made by Harris, Forbes & Company. These bonds are dated July 1, 1907, and are due in thirty years, redeemable at any interest date after 1912 at 110 and accrued interest. The Scranton Company is a consolidation of several electric light and power companies controlling the entire business of Scranton and adjoining towns. It is estimated that the company serves at the present time a population of 225,000. Provision is made under the mortgage for an annual sinking fund of 2 per cent of the total amount of bonds.

Business of the American Steel & Wire Company.—It is reported that the business of the American Steel & Wire Company during August established a new high record compared with the corresponding months of the previous years. Orders were booked, it is said, at the rate of 6000 tons per day, or 1,800,000 tons per annum. Considering the fact that August is not ordinarily a brisk month in the wire trade, this volume of business is highly encouraging. The present activity is due in a considerable measure to buying from the agricultural districts.

Crocker-Wheeler Company Orders.—The Crocker-Wheeler Company, Ampere, N. J., announces the sale to the Sierran Construction Company, Los Angeles, Cal., of three 2250-kva waterwheel-driven generators, one 100-kw interpole exciter and one 150-hp, 100-kw interpole motor-generator set; also to the city of Austin, Tex., of three 1500-kva alternating-current vertical generators, three 35-kva, 6600-440-volt self-cooled transformers, three 1000-kva, 6600-2300-volt water-cooled transformers, two 500-hp, 2300-volt induction motors and two 75-kw motor-generator sets.

New Iowa City Company.—The Iowa City Light & Power Company has been incorporated in Delaware with authorized capital stock of $5,000,000. It is reported that this company is affiliated with the Tri-City Railway & Light Company, of Davenport, Ia., which is in turn controlled by the United Light & Railways Company, of Grand Rapids, Mich. Iowa City is now served by the Iowa City Gas & Electric Company, which is a consolidation of two older utility companies serving this territory.

Tennessee Railway Light & Power Company Pays First Dividend.—On Sept. 3 the Tennessee Railway, Light & Power Company paid the first regular quarterly dividend of 1½ per cent on the $10,250,000 of outstanding preferred stock. The corporation was organized last May and owns practically all the stocks of the Tennessee Power Company, the Chattanooga Railway & Light Company, the Nashville Railway & Light Company and the Cleveland Electric Company. At the time of organization of the holding company it was estimated that the earnings for the first year would be sufficient to provide for the interest on the $7,500,000 of 5 per cent preferred bonds of the Tennessee Power Company and the preferred stock of the Tennessee Railway, Light & Power Company, but as the former is still largely in a construction stage it was not thought that there would be much surplus above the provision for these charges. When the transmission lines are fully completed the company will serve a population of about 250,000, including Chattanooga, Nashville, Cleveland, Knoxville, Columbia and other towns in Tennessee, as well as Rome, Ga. The 20,000-hp installation of the Tennessee Power Company is now being extended to a total of 51,000 hp. The company still holds undeveloped power sites capable of developing 110,000 hp. The phosphate mines of Tennessee, the electric traction lines operating in that region of the State and the many new manufacturing establishments attracted by the cheap rates for electrical energy will consume all of the output not required by the underlying companies of the Tennessee Railway, Light & Power Company.

San Domingo Light & Power Company, Santiago.—Plans are being pushed by the San Domingo Light & Power Company for the construction of a hydroelectric plant of several thousand horse-power capacity on the River Yaque, about 10 miles south of the city of Santiago, San Domingo. The plant will supply energy to the seaport of Puerto Plata, a town of 7000 inhabitants, and to the city of Santiago, which has a population of 16,000. A 700-kw auxiliary steam plant is to be built at Puerto Plata for temporary service in the district pending the completion of the hydroelectric station. Electrical energy will be used in the construction of the dam on the River Yaque and for the operation of a pumping installation in connection with a new waterworks system in Santiago, Moca, La Vega and elsewhere, superseding the use of human water-carriers. The transmission line between Santiago and Puerto Plata will pass through a mountainous country resembling the Sierras of California. The project is being completely financed in Boston, the following gentlemen being associated with the San Domingo Company: President, J. J. Moore; consulting steam engineer, George H. Barrus; hydraulic engineer, H. S. Ferguson, New York; general manager, J. L. Bryne; electrical superintendent, George T. Street; consulting electrical engineer, N. J. Neall, Boston. All matters relating to the San Domingo company are being handled by Moore & Company, Pemberton Building, Boston.

The Hall Railway Signal Company Succeeds the Hall Signal Company.—The Hall Railway Signal Company has been incorporated at Portland, Maine, as the successor to the Hall Signal Company, under the reorganization plan. The capital stock of the new company is $5,000,000. Six per cent debentures will be issued to the extent of $1,000,000 par value for the purpose of adjusting and paying off the floating debt and obligations of the old company. The new company, it is said, will commence business with more than $500,000 cash in its treasury and with an additional $600,000 of quick assets in bills and accounts receivable, without any floating debt. It has been announced also that the new company has on hand unfilled orders approximating $2,000,000, and the plans for the future are said to contemplate the enlargement of the plant at Garwood, N. J., and the entrance of the company in a broad way into the interlocking switch business.

Heany Lamp Company Assets Sold to the Independent Lamp & Wire Company.—It is formally announced that the Independent Lamp & Wire Company, 1733 Broadway, New York, has purchased the assets and good will of the Heany Company, the Heany Lamp Company and the Heany Fire-Proof Wire Company, assuming in addition all uncompleted contracts undertaken by any of these three companies. The new company also announces that it intends to continue the plants which it has hitherto operated at Weehawken, N. J., and York, Pa. The Independent Lamp & Wire Company furthermore announces that it will manufacture the type of tungsten-filament lamps covered by the Karl Farkas patents as well as continue the manufacture of the asbestos-insulated magnet wire known under the trade name of "Salamander."

Organization of Intercity Power Company to Succeed Long Acre Electric Light & Power Company.—It has been announced that the Intercity Power Company, of New York City, which was recently incorporated under the laws of the State of Delaware, will take over the entire franchise, property and assets of the Long Acre Electric Light & Power Company. It is also reported that the new company proposes to furnish light and power for lighting and motor service throughout the city of Greater New York and will enter into an agreement with the Hudson & Manhattan Railroad Company to receive all of the latter's surplus electrical energy. No details have yet been announced.

Pittsburgh & Butler Street Railway Company Abandons Alternating-Current Equipment.—The single-phase alternating-current system of electric traction now in use on the Pittsburgh & Butler Street Railway between Pittsburgh and Butler will be abandoned in favor of the 1200-volt direct-current system. The main generating station is located at Renfrew, about midway between the terminal points. Nine substations will be established along the 33 miles of line between terminals, for supplying lighting and motor service to several of the towns traversed. Energy will be transmitted at 22,000 volts. The cars and substations will be equipped by the General Electric Company.

Railway Safety Committees Organized at Los Angeles, Cal.—The Pacific Electric Railway Company, Los Angeles, Cal., has appointed a division safety committee and a central safety committee to meet every month for the purpose of discussing ways and means to prevent railway accidents to both the public and employees. The division committee is to be composed of one man from each department, while the central committee will be made up of officials of the company representing the entire system. All employees will be invited to submit recommendations or discussion pertaining to the cause and prevention of accidents on the company's lines.

New York State Railways Bond Issue Authorized.—The stockholders of the New York State Railways, Rochester, N. Y., have approved a plan to execute a first consolidation and refunding mortgage to secure an issue of fifty-year 4½ per cent bonds of the par value of $50,000,000. It is announced that the plan is to cancel the company's existing mortgage authorizing the issuance of $30,000,000 of 5 per cent bonds. Of the $4,500,000 of 5 per cent bonds which have been issued, all are in the hands of trustees.

New York Railway Company Asks for Approval of Bond Issue.—The New York Railway Company has applied to the Public Service Commission for the First District of New York for permission to issue $2,600,000 of additional bonds. The proceeds of the issue are to be applied to the purchase of 320 additional cars of the stepless type and other improvements. These bonds are thirty-year 4 per cent first real-estate and refunding mortgage, and $16,299,167 have already been issued.

Iowa Public Service Corporation, Cedar Rapids, Ia.—It is reported that the Iowa Public Service Corporation will be organized under the laws of Iowa, with a capital stock of $6,000,000, for the purpose of taking over the properties in which W. G. Dows, J. H. Smith and J. A. Reed and their associates are interested. These include the Cedar Rapids and Iowa City Railway & Light Company, the Boone Electric Company and the Marshalltown Light, Power & Railway Company.

Brazilian Traction, Light & Power Company, Ltd., Montreal, Que.—The board of directors of the Brazilian Traction, Light & Power Company has declared operative the plan for the exchange of the securities of the company for the stock of the Rio de Janeiro Tramway, Light & Power Company, Ltd., the Sao Paulo Tramway, Light & Power Company, Ltd., and the Sao Paulo Electric Company, Ltd., which was referred to in these columns last week.

Permanent Exhibit of Railway Supplies in Chicago.—A permanent exhibition of railway supplies has been open to the public in Chicago for several months. It is a private enterprise, but is free to visitors. The exhibit occupies the twelfth floor of the new Karpen Building, 900 South Michigan Avenue. It is planned for railway men, particularly, and is designed to show devices, materials and specialties in which they are interested. The exhibition hall contains 26,000 sq. ft. of floor space, divided into about 150 booths of various sizes, which are rented to manufacturers. A large proportion of the exhibit spaces are still vacant. The booths are attractively fitted up with desks, chairs and tables, and in some cases are used as the offices of the representatives of out-of-town concerns. An assembly room, seating 250, is provided, and here several societies of railway men hold their meetings. Concerns like the Crane Company, Pyle National Electric Headlight Company, Verona Tool Works, Gold Car Heating & Lighting Company and International Correspondence Schools are among the exhibitors.

Westinghouse Electric & Manufacturing Company Orders.—Among the large orders recently received by the Westinghouse Electric & Manufacturing Company are two from South America. The Rio de Janeiro Tramway, Light & Power Company, Rio de Janeiro, Brazil, has ordered 100 No. 304 motors and 110 type K-35-G controllers; F. H. Walter & Company, Rio de Janeiro, have ordered two quadruple No. 101-G motors with type K-28 control and three double equipments consisting of No. 101-G motors with type K-10 control. The motors last mentioned are for narrow-gage railway service. An order has also been received from the Milwaukee Electric Light & Railway Company, Milwaukee, Wis., for thirty quadruple equipments of No. 306 type C-A-2 motors with type K-35-G control. The August business of the Westinghouse Electric & Manufacturing Company maintained the high record thus far established for the current fiscal year, and the company is now reported to be doing the largest business in its history, probably at a rate in the close neighborhood of $40,000,000 per annum.

Manhattan Bridge Three-Cent Line.—The application of the Brooklyn Rapid Transit Company and associated traction companies for an injunction restraining the Edison Electric Illuminating Company of Brooklyn from supplying power to the Manhattan Bridge Three-Cent Line has been denied by Supreme Court Justice Kelby in Brooklyn. In upholding the right of the new line to commence operation immediately, Justice Kelby said that the Public Service Commission had determined that public convenience and necessity required the construction and operation of this new route, and that the finding of the commission is binding. The court stated that the plaintiffs apparently had no greater interest in the Manhattan Bridge than any ordinary citizen and had no vested rights which would be affected, particularly in view of the fact that the grant to the Three-Cent Line is not an exclusive one.

New York City Street Railway Accidents.—The July report of accidents on railroads and street railroads in the city of New York issued by the Public Service Commission for the First District reflects the progressive reduction in the number of persons killed. This report shows that twenty-nine persons were killed, compared with forty-one in the corresponding month last year and forty-six two years ago. The number of serious accidents was 208, compared with 233 a year ago and 359 two years ago. The total number of accidents of all kinds shows an increase about in proportion to the increase in traffic, being 6548 in July this year, compared with 6046 last year and 5772 in July, 1910.

Foreign Tariff Notes.—All changes of importance in customs tariff or regulations of foreign countries during the last two years are shown in "Foreign Tariff Notes," of which No. 7 has just been issued by the Bureau of Foreign and Domestic Commerce of the Department of Commerce and Labor, Washington, D. C. This number contains also a cumulative index of all numbers issued to date. This publication prints for permanent reference the notices of changes in foreign tariffs, as well as customs and consular regulations. It appears about once every three months and copies of all seven numbers can be obtained from the Department of Commerce and Labor.

New York Telephone Company Acquires Independent Plant.—Notice has been served on the Public Service Commission for the Second District of New York by the New York Telephone Company that the physical property and business of the Citizens' Standard Telephone Company has been purchased for the sum of $152,700. The Citizens' company has been operating in Kingston, Rosendale, Shokan and vicinity. Under the law the consent of the commission was not necessary before this change in ownership could take place.

Organization of the Kentucky Utilities Company.—Announcement has been made of the incorporation of the Kentucky Utilities Company, of Louisville, Ky., with an authorized capitalization of $2,000,000, for the purpose of operating electric, gas and water utilities in the vicinity of Louisville. It is said that Chicago capitalists are back of the new company, but details are not yet obtainable. The Louisville district is now served by the Louisville Lighting Company and the Kentucky Electric Company.

Demand for United States Telephone Company Bonds.—It is reported there is a continued demand for the bonds of the United States Telephone Company, which operates in Ohio. The supposition is that these bonds are being sought for the account of J. P. Morgan & Company, in anticipation of the eventual consolidation of the company with the Bell interests. The price of these bonds has advanced about 10 points within a short time, and they are now selling in the vicinity of 88.

Electrolytic Process Company Placed in Hands of Receiver.—Judge Hough has appointed Elihu Root, Jr., receiver for the Electrolytic Process Company, of 225 West Thirty-ninth Street and 309 De Kalb Avenue, Brooklyn, under a bond of $2,500. The application for receivership was made by the attorneys for all interested. The affidavit of August Leuchter, vice-president of the company, asking for an investigation into the affairs of the company was presented to the court.

PRICES IN NEW YORK METAL MARKET.

	Aug. 27		Sept. 3	
Copper:				
Standard:	Bid.	Asked.	Bid.	Asked.
Spot	17.25	17.50	17.25	17.62½
August	17.25	17.50	.....	.....
September	17.25	17.50	17.25	17.62½
October	17.25	17.50	17.35	17.62½
November	.....	.....	17.30	17.62½
London quotation:	£ s d		£ s d	
Standard copper, spot	79 15 0		79 6 3	
Standard copper, futures	79 17 6		79 15 0	
Prime Lake	17.65 to 17.70		17.60 to 17.65	
Electrolytic	17.60 to 17.70		17.55 to 17.65	
Casting	17.40		17.37½	
Copper wire, base	19.00		19.00	
Lead	4.65		4.80	
Sheet zinc, f.o.b. smelter	8.75		8.75	
Spelter, spot	7.20		7.37½	
Nickel	40.00 to 41.00		40.00 to 41.00	
Aluminum:				
No. 1 pure ingot	21½ to 22½		21½ to 22½	
Rods and wire, base	32		32	
Sheets, base	33½		33½	
OLD METALS.				
Heavy copper and wire	15.75		15.75	
Brass, heavy	10.00		10.00	
Brass, light	8.25		8.25	
Lead, heavy	4.40		4.60	
Zinc, scrap	5.75		5.75	

COPPER EXPORTS IN AUGUST.

Total tons, including	Aug. 27, 22,801	Sept. 3, 29,526

STOCK MARKET PRICES.

	Aug. 28.	Sept. 4.
Allis-Chalmers	¼*	¼*
Allis-Chalmers, pf.	1⅜	2½
Amalgamated Copper	87⅝	86¼
Amer. Tel. & Tel.	144⅞	144⅜
Boston Edison	291*	291*
Commonwealth Edison	139	138
Electric Storage Battery	57	57
General Electric	182¼	182½
Mackay Companies	87¾	87½
Mackay Companies, pf.	69½	69⅜
Philadelphia Electric	23⅜	23⅜
Western Union	82¼	81½
Westinghouse	87	86½
Westinghouse, pf.	125	124

*Last price quoted.

Personal

Mr. A. E. Mason has been appointed city engineer of the town of Prince Rupert, B. C., Can.

Mr. K. L. Aitken, manager of the Toronto Hydro-Electric System, is at present in England on a leave of absence.

Mr. Hilson Warfield, formerly manager of the new-business department of the City Light Company, Hopkinsville, Ky., has become associated with the sales staff of the Louisville (Ky.) Lighting Company.

Mr. R. J. Dinwoodey, for many years connected with the Capital Electric Company, of Salt Lake City, Utah, has become associated with the sales department of the Inter-Mountain Electric Company of the same city.

Mr. H. M. Byllesby, who is so well known to the electrical industry, is now president of the Civic Federation of Chicago, and is taking an active part in the movement to bring about reform in methods of taxation in the State of Illinois.

Mr. F. Lydall, manager of the railway department of Siemens Brothers Dynamo Works, Ltd., Westminster, London, England, is spending the first two weeks of September visiting the important electric-railway installations in this country.

Mr. William B. Boyd, chief engineer of the Toronto Power Company, Niagara Falls and Toronto, Ont., has resigned to take general supervision of the electrical department of the Canadian Northern Railway, a Mackenzie and Mann property.

Mr. H. A. Storrs, of Denver, Col., has recently become associated with the Edmund T. Perkins Engineering Company, First National Bank Building, Chicago, Ill., as consulting engineer. Mr. Storrs is a member of the American Institute of Electrical Engineers.

Mr. Kenneth Myers will soon sever his connection with the Gallup (N. M.) Electric Light Company and join the forces of the Cedar Rapids & Iowa City Railway & Light Company, of Cedar Rapids, Ia. Mr. Myers was formerly associated with the electric light company at Perry, Ia.

Mr. J. G. Pomeroy has resigned his position as sales manager of the Adams-Bagnall Electric Company and will spend a vacation of three or four months in southern California. Although he has made no definite plans for the future, doubtless he will continue his activities in the electrical field.

Mr. U. P. Wooldridge, local manager of the Cheyenne (Wyo.) Light, Fuel & Power Company, one of the Northern Colorado Power Company's interests, has resigned. Mr. Wooldridge has been connected with the company since June, 1906, having charge of the plants at Greeley and Boulder, Col., and Cheyenne, Wyo.

Mr. Frank O'Neill, who was formerly associated with the Pacific Telephone & Telegraph Company, has been appointed to the newly created position of electrical engineer of the Bureau of Fire Alarm and Police Telegraph of Los Angeles, Cal. The appointment has been confirmed by Mayor Alexander and the City Council.

Mr. T. A. Strasswick has been appointed contract agent of the Muskogee (Okla.) Gas & Electric Company, succeeding Mr. Norman B. Hickox, who resigned recently to become manager of the Greenwood Advertising Company, Knoxville, Tenn. Mr. Strasswick has been stationed at Muskogee for several years as Mr. Hickox's assistant.

Mr. Errett Luther Callahan, manager of the new-business department of H. M. Byllesby & Co., Chicago, Ill., has been elected secretary of the Commercial Section of the National Electric Light Association. In addition to these new duties Mr. Callahan will continue his work in connection with the committee on the Commercial Section "Digest."

General George H. Harries, president of the Louisville (Ky.) Lighting Company, who is also commandant of the coast defense artillery of the District of Columbia, has just returned from the latter place after five days of sham battling. General Harries had charge of the "reds" during the period of military maneuvering against a temporary enemy, the "blues."

Mr. Peter W. Sothman, formerly chief engineer of the Hydro-Electric Power Commission of Ontario, has established headquarters in the Whitehall Building, New York, for the practice of consulting electrical engineering under the firm name of P. W. Sothman & Company. His associates in the company are Messrs. J. A. Grundige and F. P. Mansbendel. The company will continue to maintain engineering offices in Toronto, Can.

Mr. Gano Dunn, past-president of the American Institute of Electrical Engineers, has presented to the College of the City of New York, from which he was graduated in 1889, a Poulsen set of radio-telegraph and radio-telephone apparatus which will soon be set up at the college. The gift of the wireless outfit was made in recognition of the assistance Mr. Dunn received while at the college, where he aided himself by acting as a night telegrapher. The apparatus is of the high-power long-distance type, consisting of the instruments used by the government at San Francisco. The original cost of the set has been estimated at $13,000.

Mr. Robert Francis Pack, president of the Canadian Electrical Association, honorary president of the Toronto Company Section of the National Electric Light Association, and general manager of the Toronto Electric Light Company, Ltd., has severed his connection with the latter company and joined the staff of Messrs. H. M. Byllesby & Company, whose interests he will look after in Minneapolis, where he will be stationed under General Harries. Mr. Pack has been with the Toronto company ever since a lad and worked his way up through the various grades to the top. He is one of the best known central-station men in Canada and his name is linked inseparably with central-station development in the Dominion. While he will naturally be missed in Canada, he will be a valuable acquisition to the Byllesby forces.

Mr. E. C. Deal, general manager of the Augusta-Aiken (Ga.) Railway & Electric Corporation, who was recently elected president of the Georgia Section of the National Electric Light Association, has been connected with the N. E. L. A. for the past fourteen years. His business career began in his native State with the Georgia Electric Light Company, Atlanta. Subsequently, in 1904, he assumed charge of the Bergen County (N. J.) Gas & Electric Company, and after this company was taken over by the Public Service Corporation of New Jersey he was placed in charge of the central New Jersey territory for the corporation. He resigned this position to become general manager of the properties of W. N. Coler & Company in North Carolina. In 1911 he became associated with J. G. White & Company as general manager of the Augusta-Aiken Railway Company and the Augusta Railway & Electric Company, which have recently merged into the corporation of which he is now general manager. Mr. Deal is a member of the American Street Railway Association and the American Gas Institute. He is also a member of commercial and country clubs in Greenboro, N. C., and Augusta, Ga.

Obituary

Mr. Darlington Turnbolt, president of the Louisiana (Mo.) Light, Power & Traction Company, died at the home of his daughter on Aug. 22. Mr. Turnbolt was eighty-six years old. He was at one time Mayor of Lincoln, Ill., and was the organizer of the National Gas Works Building Company, of St. Louis, Mo.

Mr. Arthur D. Wheeler, former president of the Chicago Telephone Company, died suddenly at his summer residence in Lake Forest, Ill., on Aug. 29. Mr. Wheeler was a lawyer by profession and fifty-one years old. At the time of his death he was chairman of the board of directors of the Chicago Telephone Company and a director of the Western Electric Company.

Mr. Ralph Carter Peck, lamp specialist for the General Electric Company on the Pacific Coast, died at Berkeley, Cal., on Aug. 25, after a long illness. He was born in San Francisco and was thirty-two years of age at the time of his death. His first work with the General Electric Company was in the order-handling division, and from that position he advanced until he was made incandescent lamp specialist in 1909.

Construction

HUNTSVILLE, ALA.—Electricity generated by the power plant at the falls on Little River will soon be transmitted to Huntsville and several other Alabama and Tennessee cities by the Alabama Pwr. & Devel. Co., of Huntsville. The company has taken options on the property of the Huntsville Ry., Lt. & Pwr. Co. and is planning to construct an electric railway from Decatur to Huntsville, for which surveys have been completed.

TUSKEGEE, ALA.—Bids will be received until Sept. 24 for the construction of a central heating and lighting plant for the Tuskegee Normal and Industrial Institute, Tuskegee. The work includes the construction of a power house and coal bunker, 192 ft. x 112 ft.; water-tube boilers, engines, generators, transformers, motors, electric transmission system and underground steam transmission system. Plans and specifications may be seen at the office of R. R. Taylor, director of industries, Tuskegee Institute; Walter G. Travis, Cincinnati, Ohio, consulting engineer; Builders & Traders' Exchange, Birmingham, and at the Contractors and Dealers' Exchange, 826 Perdido Street, New Orleans.

PHOENIX, ARIZ.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 9, for the installation of an electric elevator in the United States post office and custom house building, Phoenix, Ariz., plans and specifications for which may be obtained at the above office or at the office of the custodian of the building, Phoenix. Oscar Wenderoth is supervising architect.

LITTLE ROCK, ARK.—The Merchants' Ltg. Co., recently incorporated, has purchased the franchise recently granted by the City Council to the Arkansas Cold Storage Co. A 2000-kva steam-turbine-driven plant will be installed at once. Both polyphase and single-phase alternating current, as well as direct current, will be furnished in the business district. The company is capitalized at $500,000. The officers are: E. Cornish, president; Christian Ledwidge, vice-president; C. E. Rose, secretary and manager, and Isaac Kempner, treasurer.

ALVISO, CAL.—Work has begun on the construction of a substation for the Sierra & San Francisco Pwr. Co., which is to be located about 3 miles from this city. The cost of the plant is estimated at $25,000.

FORT SEWARD, CAL.—Surveys are being made for laying out the town site of Fort Seward. It is understood that G. Y. Henderson, of Eureka, and Supervisor Samuel Ledgerwood, of Trinity County, who are installing an electric plant near Zenia on a branch of Dobbyn Creek, have a tentative contract to furnish electricity for lamps and motors here. Fort Seward has not a post office.

HEMET, CAL.—The Southern Sierras Pwr. Co. has purchased a site at the corner of Florida and Gilbert Streets, Hemet, on which it will erect a new building.

LOS ANGELES, CAL.—The Home Tel. & Teleg. Co. has taken out a permit to erect a new substation on Arlington Street, Los Angeles.

LOS ANGELES, CAL.—Plans are being prepared in connection with the municipal railway, to extend from the harbor to the business district, by which a loop will encircle the entire industrial district.

LOS GATOS, CAL.—The Pacific Gas & El. Co. has purchased the property of the Los Gatos Ice, Gas & El. Co. The purchase price is said to be $187,762 and includes ice, gas and electric plants.

PALO ALTO, CAL.—Sealed bids will be received by the Board of Public Works until Sept. 23 for furnishing and installing a steam condensing plant and an electric generating unit at the municipal electric plant. Frank Kasson is clerk.

QUINCY, CAL.—The Indian Valley Lt. & Pwr. Co., Greenville, has applied to the Board of Supervisors for a franchise to erect a transmission line around Indian Valley and to other points.

RED BLUFF, CAL.—The State Railroad Commission has authorized the Sacramento Valley R. R. Co. to issue $4,250,000 in capital stock. The company proposes to build an electric railway in the Sacramento Valley beginning at Red Bluff and extending in a southerly direction through Tehama, Glenn, Colusa and Yolo Counties to Woodland and thence to Dixon in Solano County, where connection will be made with the Antioch & Eastern Ry. A branch line is also contemplated from Colusa to Williams. The railway will be about 160 miles long.

RICHMOND, CAL.—Arrangements have been completed whereby the Great Western Pwr. Co. will supply electricity throughout Richmond Annex. Work will begin immediately on the erection of a transmission line along the Panhandle Boulevard.

SAN BERNARDINO, CAL.—The Southern Sierra Pwr. Co., it is reported, contemplates installing a third unit at its generating plant in this city.

SAN FRANCISCO, CAL.—Plans have been completed by C. P. Weeks for a power house to be built by the Union Iron Works Co. at its Petrero plant, to cost about $75,000.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Public Works until Sept. 11 for additional and finishing present electrical work at the San Francisco Hospital.

SAN FRANCISCO, CAL.—The contract for furnishing and installing the underground conduit and appurtenances in Geary Street, between Kearny Street and Presidio Avenue, for use in connection with the feeder cables for the Geary Street municipal railway, has been awarded to Gruver & McCaffrey.

TROPICO, CAL.—The business men along San Fernando road will erect ornamental posts in front of their stores in connection with the 100 incandescent lamps to be installed by the city in the near future.

TROPICO, CAL.—The town of Tropico has entered into a contract with the Pacific Lt. & Pwr. Co., Los Angeles, for lighting the streets of the town for a period of five years. The company is to furnish 100 40-watt incandescent street lamps.

VALLEJO, CAL.—The City Commissioners have adopted a resolution accepting the proposition of the Chabot interests to supply the city of Vallejo with water. It is understood that electrically operated pumps will be installed at once at Lake Chabot.

WASHINGTON, CAL.—Plans are being considered for the installation of a complete electric plant at the Arctic mine in the near future. J. V. Fline is manager.

BROOKSVILLE, FLA.—The Brooksville Lt. & Pwr. Co., recently organized, will take over the local water, light and ice plants. Improvements are contemplated by the company, including extensions to water mains, building 1,000,000-gal. standpipe for reserve supply, etc.

BOWDON, GA.—The proposition to issue $8,000 in bonds for the construction of an electric-light plant will be submitted to the voters on Sept. 28.

MACON, GA.—Bids will be received by Bridges Smith, clerk of Council, until Sept. 10 for lighting the streets, parks, alleys and public buildings of the city of Macon for a period of five years, beginning July 1, 1913. W. A. McKenna is chairman of the committee on lights and electricity.

SAVANNAH, GA.—The Great Eastern Lumber Co. is building a modern village just west of Savannah, which will be inhabited by several hundred workmen who will be employed by the company. The plans provide for electric lights, sewerage and other modern conveniences. The town will be known as Port Wentworth.

VALDOSTA, GA.—Sealed proposals will be received at the office of Louis R. Benz, architect, Valdosta, until Sept. 16, for installing plumbing, steam heating, electric wiring and an electric elevator in Valdes Hotel, Valdosta. Copies of drawings and specifications may be obtained from the architect, for which a deposit of $15 will be required, which will be refunded upon return of the plans. C. B. Ashley is president of the Valdes Hotel Co.

HONOLULU, HAWAII.—Bids will be received at the office of the depot quartermaster, War Department, Washington, D. C., until Oct. 3, for furnishing generating sets and switchboards for laundry plant at Schofield Barracks, Hawaii. J. E. Normoyle is depot quartermaster.

BOISE, IDAHO.—The More's Creek Bowlder Gold Dredging Co. is planning to install electrical machinery for working the channel in More's Creek, in Boise County, for gold.

LEWISTON, IDAHO.—Surveys will soon begin by the Nez Perce & Idaho R. R. Co., Nez Perce, for an electric railway, which is to be built across the Craig Mountains, from Forest to Waha, and through the Tammany section to Lewiston.

GIBSON CITY, ILL.—Steps have been taken toward the installation of an ornamental street-lighting system on Sangamon Avenue. It is proposed to use the cluster-lamp system.

HARVARD, ILL.—An agreement has been entered into between the Harvard Lt. & Pwr. Co. and the North Shore El. Co. whereby the latter will erect a transmission line to serve local patrons when the Harvard company is unable to carry the load.

MAYWOOD, ILL.—The Town Council is contemplating the installation of an electrolytic sewage plant here. Prof. Edward Bartow, of the University of Illinois, has been engaged to make investigations and report on same.

MORTON, ILL.—The property of the Morton Lt., Ht. & Pwr. Co. has been purchased by H. E. Chubbuck, of Peoria, general manager of the Illinois Trac. system.

PALMER, ILL.—The Morrisonville El. Lt. Co., Morrisonville, is contemplating extending its transmission line to Palmer, a distance of 4 miles, to supply electricity for lamps and motors. The company, it is reported, is planning to install a larger generator in its plant.

PITTSFIELD, ILL.—Messrs. Whiting & Kendall have sold the electric light and power franchise here and the franchise for a distributing system in Griggsville, to the Middle West Utilities Co., of Chicago.

QUINCY, ILL.—The property owners on Sixth Avenue have agreed to install 15 ornamental street lamps.

ROBERTS, ILL.—At an election held recently the proposition to install an electric-light system here was carried.

ROODHOUSE, ILL.—The property of the Central Lt., Ht. & Pwr. Co., Roodhouse, has been purchased by the Middle West Utilities Co., of Chicago.

ST. FRANCISVILLE, ILL.—Steps have been taken to secure the installation of an electric-lighting system here. The Central Illinois Utilities Co. may extend its transmission lines from Lawrenceville to St. Francisville to supply electricity for the service.

SULLIVAN, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, is negotiating for the purchase of the property of the Sullivan El. Co.

TAYLORVILLE, ILL.—The contract for furnishing electricity for lighting the Christian County court house and jail has been awarded to the Taylorville Lt., Ht. & Pwr. Co., at 8½ cents per kw-hr.

TOLONO, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased the electric plant of the Tolono El. Lt. & Ice. Co.

MOUNT VERNON, IND.—The merchants have submitted a proposition to the Council offering to install cluster lamps in the business district, provided the city will pay for their maintenance.

PRINCETON, IND.—H. H. Heinrichs, of Chicago, Ill., acting for a syndicate of Eastern capitalists, has taken a 60-day option upon the electric and power plants in Princeton, Oakland City, Owensville and Fort Branch, Ind., with a view of consolidating these utilities.

CEDAR RAPIDS, IA.—The stockholders of the Cedar Rapids & Iowa City Ry. Co. have authorized the formation of a utilities corporation for the purpose of taking over the properties of Messrs. Dows, Smith, Reed and others. The company will be known as the Iowa Public Service Corporation and will be capitalized at $6,000,000.

CHELSEA, IA.—The property of the Chelsea El. Lt. & Pwr. Co. is reported to have been purchased by Col. Dows & Co., of Cedar Rapids, Ia.

DOWS, IA.—Work will soon begin on the construction of the new electric plant of the Dows El. Lt. & Pwr. Co. A direct-current, 220-volt, three-wire system will be installed. The plant will be driven by gas engines and equipped with storage batteries. W. T. McCaskey, of the Seagar Engine Works, Lansing, Mich., is interested in the company.

ELDORA, IA.—The property of the Eldora El. Lt. Co. has been purchased by E. H. Lundy, president of the Park Dam Co., for $22,000. The plant will be used as an auxiliary to the system of the Park Dam Co., Eldora.

LAMONI, IA.—The Herald Publishing Company, Lamoni, has applied to the Board of County Supervisors for a franchise to erect and operate electric transmission lines along the highways of Decatur County for a period of 20 years.

LEHIGH, IA.—The City Council has entered into a contract with the Central Iowa Lt. & Pwr. Co., Fraser, whereby the latter will furnish electricity to operate the new municipal electric-light system. The contract is for a period of 10 years and a continuous service will be furnished. The city will erect its own distributing system. The company is allowed the privilege of furnishing power direct to any customer in the city using over 10 hp. The installation of electric motors is contemplated by the large clay manufacturing plants in Lehigh.

MANCHESTER, IA.—The City Council has decided to extend the electrolier street-lighting system over three of the principal streets of the city.

MARCUS, IA.—The proposition to issue $16,000 in bonds for the construction of a municipal electric-light plant will be submitted to the voters on Sept. 16.

MARSHALLTOWN, IA.—The Board of Supervisors has granted Dows, Smith, Reed & Cook, of Cedar Rapids, a franchise to erect transmission lines along the highways of the county.

MECHANICSVILLE, IA.—A franchise for the installation of an electric plant here has been granted. Electricity for operating the system will be purchased.

MONTOUR, IA.—At an election held recently the proposition to grant a franchise to Dows, Smith, Reed & Cook, of Cedar Rapids, to install and operate an electric system was carried. The voters at La Grand have also voted in favor of granting the above-named parties a franchise there.

SIOUX CITY, IA.—A special election has been called to vote on the proposition to grant a franchise to the Sioux City Tel. Co. The proposed measure authorizes the Sioux City company to purchase the property and holdings of the Iowa Tel. Co.

SPRINGVILLE, IA.—At an election held recently the proposition to grant a franchise to the Wapsie Pwr. & Lt. Co. was carried.

TITONKA, IA.—Plans are being considered by R. L. Lamoreub to install an electric-light plant at the garage to furnish electricity for street, residential and commercial lighting. If sufficient business is guaranteed he will enlarge the plant and furnish a 24-hour service.

WALCOTT, IA.—The People's Lt. Co. has been granted a franchise to erect a high-tension transmission line into Walcott from the line of the Davenport-Muscatine Interurban Ry. Co. at Blue Grass. The proposed line will be 6½ miles in length and will cost about $27,000.

WAVERLY, IA.—The Board of Supervisors has adopted specifications for an electric-light plant for the County Home, for which bids will soon be called.

WEST UNION, IA.—The plant and holdings of the West Union El. Lt. & Pwr. Co., owned by Neff Brothers, have been purchased by C. Miller & Sons. The new owners will operate the local plant to supplement the power from Turkey River.

HUTCHINSON, KAN.—Steps have been taken by the Hutchinson Commercial Club for the installation of an ornamental street-lighting system on Main Street. V. M. Wiley is a member of the committee appointed to look into the matter. It is proposed to replace the present wooden poles with ornamental iron lamp standards carrying cluster lamps.

SALINA, KAN.—Arrangements have been made whereby the installation of an ornamental street-lighting system in the business district is assured. Lamp standards carrying five-lamp clusters and three-lamp clusters are under consideration. F. W. Esktrand is chairman of the lighting committee.

IRVINE, KY.—The installation of a lighting plant in Irvine is contemplated by Edwin C. Stevens.

PINE KNOT, KY.—Application has been made to the village authorities by William Cornelius, Williamsburg, and Daniel Taylor, Jellico, for a franchise to install an electric-light plant here, to cost about $3,000.

LAKE PROVIDENCE, LA.—Additional machinery, including dynamo and engine, will be installed in the municipal electric-light plant, bids for which will be received until Sept. 24.

BALTIMORE, MD.—The Consolidated Gas, El. Lt. & Pwr. Co. contemplates increasing its capital stock from $44,000,000 to $45,000,000, the proceeds to be used for improvements and extension to its electrical system. J. E. Aldred, of New York, is president.

BALTIMORE, MD.—Only one bid was received for furnishing electricity for the municipal buildings and schoolhouses in Baltimore. It was submitted by the Consolidated Gas, El. Lt. & Pwr. Co. The bid was ¼ cent lower than in previous years, owing to the intention of the city to supply its own globes.

CENTERVILLE, MD.—Arrangements have been made whereby the plant of the Centerville Lt., Ht. & Pwr. Co. will be taken over and operated by the municipality.

CRISFIELD, MD.—The Crisfield Lt. & Pwr. Co. will rebuild its plant, which was recently destroyed by fire.

BELCHERTOWN, MASS.—The Central Massachusetts El. Co., Palmer, has purchased the property of the Belchertown El. Lt. Co. and is erecting a transmission line to this town.

BELLINGHAM, MASS.—The Bellingham Woolen Co. has entered into a contract with the Edison El. Illg. Co. of Boston whereby the latter will supply electricity to operate the mills of the former. The contract calls for 330 hp. The two steam plants of the woolen company will be closed down.

MARLBORO, MASS.—The Board of Aldermen is considering the erection of electric lamps on Fort Meadow road.

ORLEANS, MASS.—J. F. Eldredge contemplates the installation of an electric-light plant here.

DETROIT, MICH.—The Michigan State Telephone Co. has purchased the property of the Home Tel. Co. in Detroit, at $3,500,000.

MILFORD, MICH.—The Milford El. Co. is planning to replace old pumps in the municipal water-works station with automatic electric pumps within a year. The company is negotiating with the villages of High land, Clyde and Nixon to furnish those towns with electricity for lamps and motors. Transmission lines will probably be erected within two or three months. C. C. Sherk is manager.

BOYD, MINN.—The installation of an electric-light plant in Boyd is under consideration.

CANBY, MINN.—The Canby El. Co., which has been granted a franchise to supply electricity in Minnesota, also proposes to furnish electrical service in Taunton and Porter and to farmers residing between the towns. The company will not be ready to supply the service before next spring, when an additional generator engine will be installed in its plant. Orders have been placed for another boiler.

GLYNDON, MINN.—Plans are being considered for the installation of a lighting system for the village in connection with the electric plant to be installed in the new school building.

LUVERNE, MINN.—The contract for remodeling the municipal electric-light plant has been awarded to the Northwestern El. Equipment Co., of St. Paul, at $6,373. This contract does not include the installation of new transformers or the necessary changes in the wiring of the city, the cost of which is estimated at about $4,000. The equipment will include a 135-kw alternating-current generator to be belted to the Corliss engine now in use and a 65-kw generator direct-connected to a high-speed Skinner engine.

NEW LONDON, MINN.—A committee has been appointed by the Commercial Club to investigate the proposition to install an electric-light plant in New London.

ROCHESTER, MINN.—The City Council has granted the Rochester Tel. Co. a 15-year franchise.

RUSH CITY, MINN.—The Markham-Kelsey interests contemplate a water-power development and dam on the St. Croix River, near Rush City.

ST. PAUL, MINN.—Mayor Keller has authorized the city engineer and city chemist to prepare plans and estimates on the cost of a municipal light, heat and power plant to furnish light, heat and power for city hall, jail, library, auditorium and central police station.

SARDIS, MISS.—The installation of an electric-light system in connection with the present water-works is under consideration. J. A. Davis is manager of the water-works.

HANNIBAL, MO.—Three large consumers of electricity in Hannibal have petitioned the City Council for a franchise to construct and operate an electric plant. Electrical service is now supplied by the municipal electric plant.

HOLLISTER, MO.—A bill was introduced in the late Congress by Representative Joseph Russell authorizing the municipality of Hollister to construct a dam across White River, about a mile above this town.

KANSAS CITY, MO.—Arrangements are being made by the board of trustees and the holders of the trustees' stocks and certificates of

the Kansas City El. Ry. Co., which proposes to build an electric railway from Kansas City to St. Louis, for increasing the capital stock from $15,000,000 to $30,000,000. Work on the proposed railway, it is said, will begin at Independence within 30 days. The railroad with power plants to be located near the county line of Boone and Howard Counties, in the coal field, will cost upward of $15,000,000. The additional $15,000,000 is to be used to establish extensive terminal facilities at the termini. D. C. Nevin is chairman of the board of trustees.

ST. LOUIS, MO.—The Regents' Publishing & Mercantile Co., of University City, has been granted a 20-year franchise to supply electricity for lamps and motors in the city, and also for street-lighting.

CEDAR BLUFFS, NEB.—The Fremont Gas, El. Lt. & Pwr. Co. has submitted a proposition to the Town Board offering to supply electricity to a switchboard in Cedar Rapids to operate the proposed electric-light system, for which bonds to the amount of $8,000 have been voted.

SEARCHLIGHT, NEV.—An electrically operated pump will soon be installed at the Pompeii Mine. Mr. Rulon is manager.

TONOPAH, NEV.—The Tonopah Midway Mining Co. is planning to install an electrically operated hoist at its mine.

TONOPAH, NEV.—Plans are being considered by N. S. Cutler, president of the Tonopah & Goldfield R. R. Co., and associates to develop the coal fields in Esmeralda County for coke and power purposes. The gas produced in connection with the production of coke will be utilized for fuel for an electric generating plant. It is proposed to supply electricity for mining operations in the vicinity of Tonopah.

WINNEMUCCA, NEV.—At an election held Aug. 15 the proposition to issue $180,000 in bonds to purchase the property of the Winnemucca Wtr. & Lt. Co. and for improvements was defeated.

BEDFORD, N. H.—The Manchester Trac., Lt. & Pwr. Co., Manchester, has submitted a proposition offering to extend its transmission lines to this town provided sufficient business is guaranteed.

PHILLIPSBURG, N. J.—Local capitalists are considering the advisability of establishing an electric-light plant for the purpose of competing with the local corporation. The cost of an 800-kw plant with distributing system is estimated at $75,000.

ALBANY, N. Y.—Sealed proposals subject to the usual conditions for furnishing incandescent lamps for State hospitals for a period of one year from October, 1912, will be received until Sept. 12, 1912. For further information address the purchasing committee for State hospitals, Room 138, Capitol, Albany, N. Y.

ANTWERP, N. Y.—Plans have been prepared for the new dam to be constructed by the village at Old Forge.

CANAJOHARIE, N. Y.—The Montgomery Lt. & Pwr. Co. has decided to extend its transmission lines from Sharon Springs to Cobleskill. A 24-hour service will be furnished.

MILFORD, N. Y.—The Otsego & Herkimer R. R. Co., Hartwick, has submitted a proposition to the Village Board offering to supply electricity for lighting the streets of the village. At present gas lamps are used.

NEW YORK, N. Y.—Sealed bids will be received by Henry S. Thompson, commissioner of water supply, gas and electricity, Room 1903, 13 to 21 Park Row, New York, until Sept. 16 for furnishing electrical supplies.

NEW YORK, N. Y.—Contracts have been awarded by the Department of Public Charities to the Luke A. Burke & Sons Co., 25 West Forty-second Street, New York, for the construction of an independent electric generating plant at Sea View Hospital, Staten Island, to cost $59,150, and for the installation of an additional boiler and accessories, to cost $12,000.

PENN YAN, N. Y.—Plans are being considered by the Board of Village Trustees for the installation of an underground conduit for the electric wires.

PORTLAND, N. Y.—The Niagara & Erie Pwr. Co. has received authority from the Public Service Commission to issue capital stock to the amount of $20,000 and $60,000 in bonds, the proceeds to be used to secure the right-of-way necessary for the erection of a high-tension transmission line from West Portland to the boundary line of Pennsylvania and erection of transmission lines between these points.

STAPLETON, N. Y.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 3, for gas piping, heating apparatus, conduit and wiring at the United States Marine Hospital, at Stapleton, N. Y., in accordance with specifications and drawings, copies of which may be obtained from the chief supervising engineer, 727 Custom House, New York, or at the above office. Oscar Wenderoth is supervising architect.

TALCVILLE, N. Y.—The power plant of the International Pulp Co. in Talcville was destroyed by fire on Aug. 21, causing a loss of about $25,000.

VARNA, N. Y.—The residents of Varna have asked the Ithaca El. Lt. & Pwr. Co. to submit estimates of the cost of extending its transmission line from Forest Home to Varna to furnish electricity for street and residential lighting here.

SMITHVILLE, N. C.—The contract for the construction of an electric light plant has been awarded to B. C. Copeland, Asheville. The National El. Sup. Co., Washington, D. C., was awarded the contract for pole-line, pumping machinery and electrical apparatus.

SPENCER, N. C.—Surveys are being made by the J. B. McCrary Co., engineer, Atlanta, Ga., for the proposed municipal electric-light plant.

CARRINGTON, N. D.—The City Council has decided to enter into an agreement with the Western El. Co. for street lighting, whereby the company will furnish electricity for the street lamps. Orders have been placed for 45 lamps of 30 cp. The city is to pay for the lamps and cost of installation.

HATTON, N. D.—An ornamental street-lighting system will be installed in the business district and the principal residence streets here. Lamp standards carrying three-lamp clusters will be used.

VALLEY CITY, N. D.—The contract for machinery for the municipal electric-light plant has been awarded to the Erie City Iron Works, Erie City, Pa., for $24,950. M. J. Boyd is city auditor. The City Council has decided to continue the work of installing an ornamental street-lighting system.

CLEVELAND, OHIO.—Sealed bids will be received at the office of the secretary of the director of public service, No. 104 City Hall, Cleveland, Ohio, until Sept. 12 for lead-incased, rubber-covered, two-conductor cable for the Lighting Department. Proposals must be submitted on blank furnished by the superintendent of the Water Department. W. J. Springborn is director of public service.

NEWARK, OHIO.—The American Gas & El. Co. has purchased the Thomas Foundry property, south of the B. & O. station, on which the new plant of the Licking Lt. & Pwr. Co. will be erected.

SPRINGFIELD, OHIO.—The Springfield Lt., Ht. & Pwr. Co. contemplates making improvements to its plant, involving an expenditure of about $25,000, and increasing the output by 25 per cent.

YOUNGSTOWN, OHIO.—Plans are being considered for the installation of a power plant in the Dome Theater to furnish light and power for the building.

YOUNGSTOWN, OHIO.—A report has been submitted to the Council giving the cost of the proposed dam and power plant at the Milton Reservoir. The plans provide for the construction of a dam 525 ft. wide at the spillway, with dike 2400 ft. long, and the dam proper, 35 ft. high and 20 ft. thick at the crown, to cost about $500,000, and power plant to cost $160,731.

MUSKOGEE, OKLA.—Samuel Brown, Jr., of Chicago, Ill., has closed a contract with the Muskogee Wtr. Pwr. Co. whereby Mr. Brown agrees to build a large hydroelectric power plant, at a cost of $1,000,000, on the Grand River, near Muskogee. Work will begin within 60 days.

PURCELL, OKLA.—Bids for the proposed electric-light plant and water-works system will probably be ready to advertise in about 30 days. The cost of the plants is estimated at from $25,000 to $30,000. W. B. Blanchard is Mayor.

INDEPENDENCE, ORE.—Plans are being considered for the construction of an electric railway from Independence to Buena Vista, a distance of 8 miles. H. Hirschberg, president of the Independent & Monmouth R. R. Co., is interested in the project.

SALEM, ORE.—The Southern Pacific Company, through its subsidiary company, the Portland, Eugene & Eastern El. Ry., contemplates the construction of several hundred miles of electric railway of which Salem will be the center. A large terminal station will be erected here.

SUMPTER, ORE.—The Eastern Oregon Lt. & Pwr. Co., Baker, has applied to the City Council for a franchise to erect a transmission line through the city for the purpose of transmitting power to the dredge being built below the city.

LOCK HAVEN, PA.—The merger of six electric companies in the northern and central parts of the State under the name of the Central Pennsylvania El. Co., of Lock Haven, has been approved by Governor Tener. The company is capitalized at $30,000 and has taken over the plants of the West Branch Lt., Ht. & Pwr. Co., Williamsport; Susquehanna Lt., Ht. & Pwr. Co., Jersey Shore; Logan El. Co., Bellefoute; Avis Lt., Ht. & Pwr. Co., Avis; Patterson-Scootac & Clinton Lt., Ht. & Pwr. Corpn., Lock Haven.

TACONY, PA.—The contract for the construction of a power house for H. Disston & Sons, Tacony, has been awarded to F. W. Van Loon, to cost about $50,000. The plant will be equipped with a turbo-generator.

PROVIDENCE, R. I.—In accordance with the new contract with the city, the Narragansett El. Ltg. Co. will soon replace the 47 arc lamps and 79 incandescent lamps in Roger Williams Park with tungsten incandescent lamps.

PROVIDENCE, R. I.—Plans for equipping the Pettaconsett pumping station and the high-service plant at the Hope station for electrical operation have been submitted to the city engineer's department by the Narragansett El. Ltg. Co.

JOHNSON CITY, TENN.—The Tennessee Eastern Hydro-Electric Co., which has taken over the properties of the Wautauga El. Co. and the Johnson City Trac. Co., of Johnson City, has offered to supply electricity to new industries in Johnson City free of charge for a certain period. The company is building a power dam at Greenville.

MEMPHIS, TENN.—The William R. Moore College of Technology, which is preparing to secure a site and begin operations, it is said, will soon require electrical equipment. T. O. Vinson is one of the trustees.

CRYSTAL CITY, TEX.—A committee, consisting of M. L. Williams, J. A. Jennings, O. A. Stubbs, M. L. Harkey and John Pegues, has been appointed for the purpose of organizing a company to establish an electric-light plant, ice factory and cannery

HOUSTON, TEX.—The preliminary survey has been completed for the

proposed interurban railway system that is to be built from Houston to several towns adjacent to the Houston ship channel and extending to La Porte, Sylvan Beach, Webster, Friendswood and Pearland, to be built by a French syndicate, represented by Dr. F. S. George, of Dayton, Ohio. It is stated that all financial arrangements have been made for construction of the railway.

SMITHVILLE, TEX.—Work will soon begin on the construction of a power house for the Missouri, Kansas & Texas R. R. Co. Equipment has been purchased for the plant which will supply electricity for the depot, freight office and yards.

WACO, TEX.—The City Commission has granted the Texas Pwr. Co. a franchise for its proposed electric power plant. The power station will be located in East Waco and will involve an expenditure of not less than $600,000. It is understood that substations will be installed at Hutchins, Waxahachie, Hillsboro and Rice.

PROVO, UTAH.—The County Commissioners have granted the Knight Consol. Pwr. Co., Provo, a 21-year franchise to construct and operate a transmission line over the county roads from Pleasant Grove to Provo and from the mountains to the lake. The company proposes to supply electricity for lamps and motors to residents on Provo Beach and all the section between Provo and Pleasant Grove.

SALT LAKE CITY, UTAH.—The City Commission has granted the Merchants' Lt. & Pwr. Co., Ogden, a franchise to install and operate an electric-light plant for a period of 50 years.

SOUTH POULTNEY, VT.—Equipment has arrived for the substation of the Rutland Ry., Lt. & Pwr. Co. here. The plant will have an output of about 1000 hp and will supply electricity for lamps and motors for towns in this vicinity. About $500,000, it is said, will be expended by the company within eight months in extending its street-railway and transmission systems through the quarrying districts and in further development to its public utilities. The company, it is reported, will extend the Rutland-Fair Haven-Poultney electric railway to Granville.

PULASKI, VA.—Plans are being considered for the installation of a 1500-hp steam-driven electric plant to replace the present municipal electric plant.

ARLINGTON, WASH.—The Chamber of Commerce is promoting the erection of a telephone line from Arlington to Darrington, a distance of about 25 miles.

BELLINGHAM, WASH.—The Stone & Webster Engineering Corpn. has applied to the City Council for a franchise to extend the street-car line on Guide Meridian Street, a distance of 2 miles.

CLE ELUM, WASH.—The Kittitas El. Ry. & Pwr. Co. will soon begin work on the construction of an electric line that is to connect Cle Elum and Roslyn.

GLENDALE, WASH.—Bids are being received by G. B. Woodbury, clerk of the Board of City Trustees, for copper wire. Beginning in September the lighting department will erect 200 street series tungsten lamps in the newly annexed territory. The city electrician has charge of the work.

NORTH YAKIMA, WASH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 4 for an electric passenger elevator for the United States post office and court house, North Yakima, plans and specifications for which may be secured at the above office. Oscar Wenderoth is supervising architect.

SPOKANE, WASH.—The Spokane & Inland Empire Ry. Co. is planning to extend its electric railway from Milwood, Wash., to Newman Lake, Idaho, in the near future. J. H. Young is president.

WARWOOD, W. VA.—Application has been made to the City Council by the Brooke El. Co. for a franchise to install and maintain an electric-light plant in Warwood. E. H. Wise is interested in the company.

WARWOOD, W. VA.—The Wheeling Elecl. Co., Wheeling, W. Va., has applied to the City Council for a franchise to erect transmission lines throughout the city for the distribution of electricity for lamps and motors for a period of 25 years. John B. Garden is general manager of the Wheeling company.

BLACK RIVER FALLS, WIS.—The property of the La Crosse Wtr. Pwr. Co. will be sold at a foreclosure sale on Oct. 11, at Black Falls. The plant supplies power to the La Crosse Gas & El. Co. and to manufacturing plants in Winona, Minn., and La Crosse.

ELKHORN, WIS.—The Badger Ry. & Lt. Co. has applied for a franchise to operate an electric railway in this city.

LODI, WIS.—Arrangements are being made by Byron Rapp to install an electric-light plant on his farm.

CORONATION, ALTA., CAN.—By-laws will soon be submitted to the ratepayers to appropriate $45,000 for the installation of an electric-light plant and water-works system.

VICTORIA, B. C., CAN.—Plans are being considered for illuminating the harbor in this city. The Canadian Pacific Ry. Co. has offered to assist in the project, provided the provincial government and certain property owners do their share. Captain Troup of the Municipal Council is interested.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by P. E. Ryan, secretary, at the office of the commissioners of the Transcontinental Railway, Ottawa, Ont., until Sept. 16, for furnishing and installing all piping systems, pipe tunnels, pipe coverings and wiring ducts required in connection with the car-shop plant of the Winnipeg shops, situated on the line of the National Transcontinental Railway about 6 miles east of Winnipeg. Plans may be seen and specifications and forms of tender obtained at the office of W. J. Press, mechanical engineer, Ottawa, Ont., and at the office of H. H. Pinch, assistant engineer, Transcona, Man.

AYR, ONT., CAN.—The owners of the local electric-light plant have offered to sell it to the municipality for $3,500. The Council has decided to submit to the ratepayers as soon as possible a by-law providing for purchase of plant. In case the by-law is carried it is understood that the plant will be moved to Nithvale and operated by water-power.

BERLIN, ONT., CAN.—The Berlin Light Commission has been requested by the management of the Canadian Consol. Rubber Co. to submit an estimate for furnishing the company with electrical energy to the amount of 2280 hp.

KINGSTON, ONT., CAN.—The City Council has decided to enlarge the municipal electric-light plant, at a cost of about $35,000.

LINDSAY, ONT., CAN.—The Town Council is contemplating the purchase of a new electrical transformer. D. Ray is clerk.

TODMORDEN, ONT., CAN.—The Ontario Hydro-Electric Commission, it is stated, is willing to finance the construction of distributing systems in Todmorden, Woodbine and any other populous area in York Township. The Toronto Hydro-Electric system will take over the systems and operate them if the proposition is adopted.

BEAUHARNOIS, QUE., CAN.—A company has been formed by a group of Montreal financiers and business men for the purpose of erecting a power plant at Beauharnois. Permission has been secured from the provincial government and franchises will be secured in the city of Montreal and in the counties of Laval, Jacques Cartier, Hochelaga, Laprairie, Chateauguay, Beauharnois, Two Mountains, Argenteuil, Soulanges, Vandreuil, Terrebonne, L'Assomption, Chambly, Huntington, Napierville, St. Jean and Iberville.

New Industrial Companies

THE BEACH-FIELD ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $150,000 to manufacture machinery, tools and mechanical equipment. The incorporators are C. S. Beach, H. J. Hall, Jr., C. C. Field and W. B. Sheddan.

THE EASTERN ELECTRIC COMPANY, of Pittsburgh, Pa., has filed application for a charter with the State Department. The company proposes to manufacture electrical equipment. The incorporators are Howard H. Wood, O. J. Schaefer and J. W. Smith. C. S. Crawford, Oliver Building, Pittsburgh, is solicitor.

THE C. & C. ELECTRIC & MANUFACTURING COMPANY has filed articles of incorporation in the office of the Secretary of State, Trenton, N. J. The company is capitalized at $500,000 and proposes to manufacture electrical appliances. The incorporators are: Charles L. Hyde, Peter F. Hoffman, Plainfield, N. J., and George Hills, Westfield, N. J.

THE FIAT MOTOR SALES COMPANY, of New York, N. Y., has been incorporated by Charles L. A. Whitney, William Scallon and John N. Blair. The company is capitalized at $300,000 and proposes to deal in motors, engines and other machinery.

THE GENERAL SUPPLY & EQUIPMENT COMPANY, of Trenton, N. J., has been chartered with a capital stock of $25,000 to deal in railway supplies. The incorporators are William J. Pierrepont, William U. Ale and William B. Housel.

THE HERWIG ART SHADE & LAMP COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $5,000 by H. H. Sadler, O. H. Hensel and Carl Newburger. The company proposes to deal in gas and electric fixtures.

THE INDEPENDENT LAMP & WIRE COMPANY, of Jersey City, N. J., has been granted a charter with a capital stock of $10,700 to manufacture incandescent lamps and wire and also to generate power. The incorporators are Stephen C. Fiero, Ernest J. Ellenwood, of Brooklyn; George Feinberg and Paul S. Guilfoil, of New York, and J. Emil Walscheid, Union Hill

THE JONES MANUFACTURING COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $10,000 for the purpose of selling gas and electrical fixtures. The incorporators are: H. B. Silverberg, H. J. Rosenberg and I. B. Perlman.

THE MONTAUK WIRE & THERMOSTAT COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $555,000 to manufacture mechanical and electrical devices for prevention of fire. The incorporators are E. W. Keese, M. A. Garrison, J. T. Quinlan, C. R. Rogers and H. L. Washburn.

THE PENNSYLVANIA APPLIANCE COMPANY, of Camden, N. J., has been incorporated with a capital stock of $5,000 to manufacture electrical and mechanical appliances, etc. The incorporators are George H. B. Martin, C. U. Martin and John A. MacPeak, all of 419 Market Street, Camden, N. J.

THE RITTER ILLUMINATING & MANUFACTURING COMPANY, Ltd., of St. Catharines, Ont., Can., has been incorporated with a capital stock of $75,000 to manufacture and deal in electrical appliances and

devices. The directors are Cornell Kmentt, engineer, and G. B. Burson, of St. Catharines.

THE UNITED MOTOR EQUIPMENT COMPANY, of Augusta, Maine, has been incorporated with a capital stock of $1,000,000 for the purpose of manufacturing and dealing in motors, etc. E. M. Leavitt, Augusta, is president and treasurer.

THE WILLIAM F. WOLFF COMPANY, of New York, N. Y., has been incorporated by C. L. Hepburn, E. C. Gossman and H. Rohrback. The company is capitalized at $10,000 and proposes to manufacture lamps and equipment for producing light. The company will take over the business of William F. Wolff, 32 Union Square, N. Y.

New Incorporations

WILMINGTON, DEL.—Articles of incorporation have been filed by the Iowa City Lt. & Pwr. Co. under the laws of the State of Delaware. The company is capitalized at $1,000,000 and the incorporators are: E. E. McWhiney, N. F. Coffin and H. E. Latter, of Wilmington.

CHICAGO, ILL.—The Chicago Suburban Gas & El. Co. has been incorporated with a capital stock of $6,000,000 by Burrell J. Cramer, Ralph E. Hyatt, Raymond J. Mahoney and Clarence C. Sundmacher, all of Chicago.

MONTICELLO, IND.—The Northern Indiana Utilities Co. has been incorporated with a capital stock of $1,075,000 for the purpose of taking over the public-utility plants in the small towns from Monticello to the Illinois state line. The new company has secured the electric plants in Monticello, Wolcott, Earl Park, Fowler and Kentland, Ind. A high-tension transmission line is being erected from the hydroelectric plant in Monticello to the other towns to supply electricity to operate the systems in those places. Samuel Insull is president of the company, C. A. Munroe vice-president, and A. S. Scott secretary and treasurer.

NEW YORK, N. Y.—Articles of incorporation have been filed by the Haiti Port Rys., Lt. & Pwr. Co., its purpose being to build warehouses and operate telephone and telegraph lines in Haiti. The capital stock is placed at $5,000,000, and the incorporators are John A. Chrystie, New York City; Frank J. Torpey, Brooklyn, N. Y., and Charles Sternheim, Fernwood, N. J.

NEW YORK, N. Y.—The Inter-City Pwr. Co. of New York has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $10,000,000. The company proposes to take over the rights and franchises of the Long Acre El. Lt. & Pwr. Co., New York. The incorporators are: Harry M. Duerning, Louis F. Mentz, of New York, and James W. Deevy, Brooklyn.

PORTLAND, ORE.—The Hurley Hydraulic Pwr. Trans. Co. has been incorporated with a capital stock of $50,000 by W. W. Binns, J. W. Hurley and Alexander Sweck.

FORT WORTH, TEX.—The Baptist Seminary St. Ry. Co. has been chartered with a capital stock of $25,000 to build a suburban and belt electric railway in Fort Worth. The incorporators are: L. R. Scarborough, J. K. Winston and B. C. McCarty, all of Fort Worth.

NOCONA, TEX.—The Nocona Ice & Lt. Co. has been organized with a capital stock of $15,000 by W. D. Carmichael, C. P. Dodson and H. T. Weathers.

TRINITY, TEX.—The Trinity Pwr. Co. has been incorporated with a capital stock of $4,000 by H. H. Thompson, W. A. Bell and Jacob Emery.

RICHMOND HIGHLANDS, WASH.—The Richmond Highlands Lt. & Wtr. Co. has been incorporated with a capital stock of $2,500 by William D. Perkins, R. S. Bloss and others.

PARKERSBURG, W. VA.—The Charleston-Parkersburg El. Juice Co. has been granted a charter with a capital stock of $500,000. The company proposes to establish its chief plant in Parkersburg and Clay City or Pettyville, as it is now called. The company proposes to generate electricity for light, heat and power purposes and to build in Parkersburg the necessary terminals for the railway of the Kanawha-Ohio Valleys Trade Promoting Co. The incorporators are: Albert E. Boone, H. G. Wile, Parkersburg, and George Pfalgraf, Lockport, W. Va.

WELLSBURG, W. VA.—The Brook El. Co. has been incorporated with a capital stock of $10,000 by Alonzo M. Snyder, Irvine K. Schnaitter, N. I. Young and others.

PORTAGE, WIS.—The Portage El. Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000 by R. E. York, G. E. York and John A. Raup.

RIPON, WIS.—The Ripon United Tel. Co. has been granted a charter with a capital stock of $40,000. The incorporators are: G. F. Horker, J. B. Barlow, Jr., and S. M. Pedrick.

RIVER FALLS, WIS.—The River Falls Pwr. Co. has been granted a charter with a capital stock of $75,000. The incorporators are: G. B. Skogmo, B. W. Utman and Robert A. Lang.

ROME, WIS.—The Bark River El. Lt. & Pwr. Co. has been chartered with a capital stock of $5,000 by H. H. Lepper, Alice J. Lepper and A. A. Lepper.

THIENSVILLE, WIS.—The Thiensville El. Lt. & Pwr. Co. has been incorporated with a capital stock of $3,000 by O. R. Lebscher, J. W. Schafer, M. Lebscher and A. Schafer.

Trade Publications

GENERATORS.—Bulletin No. 1136 of the Fort Wayne Electric Works of General Electric Company, Fort Wayne, Ind., deals with direct-connected direct-current generators.

ELECTRIC SPECIALTIES.—A folder from the Cleveland Storage Battery Manufacturing Company, Central Bank Building, St. Louis, Mo., gives illustrations, brief descriptions and price lists of its head-lamps, side-lamps, fittings and other specialties.

BLOWERS FOR HOT-AIR FURNACES.—Bulletin No. 3312 of the Emerson Electric Manufacturing Company, St. Louis, Mo., features electric blowers for hot-air furnaces for residence use. The blower equipment consists of a special motor driving a six-blade quiet fan mounted in a sheet-iron casing with cover and handle. The blower outfit is placed in the cold-air box of the furnace and procures a combined heating and ventilating system.

PUMPS.—Miniatures of the first page of bulletins referring to the Goulds pumps form a circular issued by the Goulds Manufacturing Company, Seneca Falls, N. Y. The inside cover contains an invitation to central-station men and others interested to send for the bulletins themselves, and the back cover may be used as the postal request for these publications, which contain a great many facts on pump construction of special interest to central-station men.

AIR COMPRESSORS.—The Barr "unit-compound" air compressor is featured in a twenty-four-page pamphlet issued by the Pennsylvania Pneumatic Company, Erie, Pa. It is said that with the increasing use of air in high-class and more efficiently managed office-building, industrial, railway and public-service plants there has arisen a demand for something special in the way of a compressor, which demand has been met by the unit-compound type which has been developed by this company.

BAKERY INSTALLATION.—Ballinger & Perrot, engineering architects, Marbridge Building, Thirty-fourth Street and Broadway, New York, have issued a brochure entitled "Evidence by Pictures," which tells briefly, with numerous illustrations, the story of the installation of the new building of the Acme Tea Company, Philadelphia, that was designed, erected and equipped throughout by this firm. A large view of the dynamo and engine room appears on the last page of this publication.

FILTERS.—The De Laval Separator Company, 165 Broadway, New York, has issued Bulletin No. 125 on its clarifier and filter, giving descriptions and illustrations of its steam-turbine style for direct steam connection and also its belt-power style. It is claimed for this apparatus that a very low amount of steam or other power is required to operate it. The company has also published some testimonials from users of its apparatus in a booklet, "A Few Users and What They Say."

Business Notes

INDIA MICA IMPORTERS' REMOVAL.—Meirowsky Brothers, importers of mica for all industrial purposes, have recently removed to 146 Liberty Street, New York.

STEEL AND WIRE COMPANY REMOVAL.—The general offices of the Philadelphia Steel & Wire Company have been moved to its Camden plant, Pearl Street and Delaware Avenue, Camden, N. J. The wire and rope warehouse of this company will remain at 525 Commerce Street, Philadelphia, Pa.

CONVENTION OF COLUMBIA LAMP SALESMEN.—During the week of Aug. 11 the sales organization of the Columbia Incandescent Lamp Works of the General Electric Company held its annual convention at Macatawa Hotel, Macatawa, Mich., a picturesque summer resort on the eastern shore of Lake Michigan. The program of the week consisted of papers and discussions of commercial interest, all of which proved both interesting and helpful.

P. W. SOTHMAN & COMPANY, who recently opened offices in the Kent Building, Toronto, as consulting electrical engineers, have also opened offices in the Whitehall Building, New York City, for engineering work in hydroelectric development, high-tension transmission and other undertakings connected with the generation and distribution of electrical energy. Messrs. J. A. Grundige and F. P. Mansbendel are associated with Mr. Sothman in the firm.

SUPPLY COMPANY'S BRANCH REMOVAL.—The American Ever Ready Company's Southern branch, which handles its business in all the states south of Virginia, including Texas, will on Oct. 1 move to 526 Bienville Street, New Orleans. This change has been made necessary by the rapid increase in business. The new building will occupy three floors, all of which will be utilized by the Southern branch. The company makes the "Everready" dry batteries, electric flashlights and other electrical devices.

MR. JOSEPH B. BAKER has become associated with Messrs. Rickard & Sloan, promoters of "productive publicity," Evening Post Building, New York. Mr. Baker is a graduate of the Massachusetts Institute of Technology, class of 1890. He has been actively and widely identified with electrical engineering work and has contributed largely to electrical literature. Mr. Baker will continue to carry on his own business at 558 West 158th Street, New York, in addition to his work with Richard & Sloan, who, in the six months of their existence, have built up a large business in their line as publicity promoters.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary-Treasurer, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention, Birmingham, November, 1912.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Chicago, Oct. 7-11, 1912.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Convention, Chicago, Oct. 7-11, 1912.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next general meeting, New York, Sept. 9-11, 1912.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 29 West 39th St., New York. Meeting, second Friday of each month, October-May.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y. Annual meeting, Cleveland, Ohio, jointly with the American Association for the Advancement of Science, December, 1912.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Seattle, Wash. Annual meeting, Hot Springs, Va., Sept. 10-12, 1912.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio. Annual convention, Hotel Pfister, Milwaukee, Wis., Sept. 23-28, 1912.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-Treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual convention, Auditorium Hotel, Chicago, Oct. 21-26, 1912.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Colo.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Colo. Annual meeting, Glenwood Springs, Sept. 12-14, 1912.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Annual meeting, Syracuse, N. Y., January, 1913.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-Treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive Committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next quarterly meeting, Hot Springs, Va., November, 1912.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, W. E. Holmes, 46 Blackstone St., Boston, Mass. Meetings monthly upon notice.

ELECTRIC VEHICLE CLUB OF BOSTON. Secretary-Treasurer, Leavitt L. Edgar, 39 Boylston St., Boston, Mass. Meeting every Wednesday, 12:30 p. m.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC & STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-Treasurer, Prof. H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria. Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Niagara Falls, Ontario, Can., Sept. 16-19, 1912.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, 120 So. Meridian St., Indianapolis, Ind. Annual meeting, Indianapolis, Oct. 16-17, 1912.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 W. Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTROCHEMICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting, first Monday of each month.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, A. W. Zahn, Mason City, Ia.

IOWA STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

KANSAS GAS, WATER, ELECTRIC LIGHT & STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Annual meeting, Manhattan, Kan., Oct. 17-19, 1912.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Strong, Chaska, Minn. Sixth annual convention, March 15-22, 1913.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER WORKS ASSOCIATION. Secretary-Treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greeneville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. H. Carlton, General Electric Company, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, M. H. Hendle, Augusta, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Semi-annual convention, Boston, Oct. 10-12, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual convention, Portland, Ore., Sept. 11-13, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, Farley Osgood, Public Service Electric Company, Newark, N. J.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, W. L. Smith, Concord, Mass.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary-Treasurer, Franklin H. Wentworth, 87 Milk St., Boston, Mass. Next annual meeting, New York, May 13-15, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-Treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St.,

New York. Board of Directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Company, Albany, N. Y.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Akron, Ohio, Nov. 21 and 22, 1912.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-Treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

PITTSBURGH ELECTRICAL BOOSTER CLUB. Recording Watt, George H. Criss, 1806 Union Bank Building, Pittsburgh, Pa. Meeting, first Monday each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, F. W. Edmunds, 3868 Park Ave., New York. Annual convention, Oct. 8-11, 1912.

REJUVENATED SONS OF JOVE. Jupiter, R. L. Jaynes, Pittsburgh, Pa.; Mercury (Secretary), E. C. Bennett, St. Louis, Mo

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

VERMONT ELECTRICAL ASSOCIATION. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention, St. Louis, Mo., Jan. 28-30, 1913.

WESTERN SOCIETY OF ENGINEERS. Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August. Annual meeting, Tuesday after Jan. 1 each year.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 27, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,036,548. ELECTRIC LAMP SOCKET; C. H. Bissell, Syracuse, N. Y. App. filed Dec. 8, 1909. Porcelain, for decorative purposes.

1,036,551. ELECTRIC LAMP; T. A. C. Both, New York, N. Y. App. filed Dec. 2, 1911. Two-piece porcelain snap with strain relief.

1,036,552. TRUCK CONSTRUCTION AND INSULATION; A. L. Bower, Boyertown, Pa. App. filed Nov. 14, 1908. Dove-tailed insulation cast in place for cab and signal systems.

1,036,554. ELECTROLYTIC CELL; F. H. Briggs, Elyria, Ohio. App. filed Sept. 13, 1911. The container and contents are removable from the cell.

1,036,571. ELECTRODEPOSITION OF METALS; J. S. Corey, Datchet, England. App. filed Jan. 13, 1911. For making printers' electrotypes. Rotatable annular electrode.

1,036,576. ATTACHING RUBBER TO METALS; L. Daft, Rutherford, N. J. App. filed Jan. 28, 1911. The surface to which the rubber is to be attached is first electroplated with an alloy of antimony, copper and zinc.

1,036,596. CENTRIFUGAL MERCURY CUT-OUT SWITCH; F. E. Fisher, Detroit, Mich. App. filed Feb. 2, 1912. For automobile ignition and lighting.

1,036,597. BATTERY BOX; H. M. Fisk, Watseka, Ill. App. filed June 2, 1911. Multiple-unit cell with cut-out cover.

1,036,605. WELDING MACHINE; H. Geisenhöner, Schenectady, N. Y. App. filed March 16, 1911. For welding space blocks to laminations for the cores for direct-current machines; electrode in the form of a gear.

1,036,612. PRESS PLATE; W. S. Hadaway, Jr., East Orange, N. J. App. filed Nov. 20, 1909. Electric heater with interchangeable units.

1,036,616. AUTOMATIC DRAFT REGULATOR FOR STEAM-BOILER FURNACES; F. W. Harrington, Coventry, R. I. App. filed Sept. 22, 1911. Electrically controlled, normally open steam valve for actuating the blower.

1,036,620. ELECTRIC SIGNALING SYSTEM; K. A. Hawley, Los Angeles, Cal. App. filed Feb. 7, 1908. Means for indicating a defective condition.

1,036,632. ELECTRIC HEATING PAD; G. Jahr, Berlin, Germany. App. filed Nov. 17, 1911. Woven fabric.

1,036,654. ANODE SUPPORT; C. E. Leffel, Meadville, Pa. App. filed Sept. 27, 1911. Hook with anode engaging enlargement.

1,036,655. ANODE SUPPORT; C. E. Leffel, Meadville, Pa. App. filed Sept. 27, 1911. T-shaped shank for engaging parallel bars.

1,036,657. SNAP-SWITCH MULTIPLE FUSE; N. E. Lemmon, Chicago, Ill. App. filed Dec. 29, 1910. Inclosed cylinder type.

1,036,688. MOTOR CONTROL; W. Naumann, Pankow, Germany. App. filed March 10, 1911. Reversible braking generator type, with permanent shunt field and two series fields.

1,036,696. TRANSFORMER CUT-OUT FOR ALTERNATING-CURRENT CIRCUITS; J. S. Peck, Manchester, England. App. filed July 15, 1909. Main and auxiliary transformer with a relay switch governing an automatic switch.

1,036,723. ELECTRICAL CIRCUIT PROTECTOR; C. A. Rolfe, Chicago, Ill. App. filed Nov. 30, 1906. Self-soldering type. Improvement on No. 867,212.

1,036,724. KEYBOARD CONTACT; C. E. Rowe, Cortland, N. Y. App. filed May 16, 1911. For bell ringing.

1,036,742. AUTOMATIC ENGINE STOP; L. P. Strong, Cleveland, Ohio. App. filed July 19, 1911. Electric circuit connections for operating a steam throttle.

1,036,744. INCANDESCENT ELECTRIC LAMP; E. H. Tate, Los Angeles, Cal. App. filed Sept. 5, 1911. Self-cooling stem.

1,036,754. CONTROLLER FOR ELECTRIC MOTORS; T. Varney, Pittsburgh, Pa. App. filed Jan. 7, 1911. Auto starter for polyphase induction motors.

1,036,757. DYNAMO-ELECTRIC MACHINE; M. Walker, Hale, England. App. filed Nov. 30, 1910. Rotary converter.

1,036,789. CURRENT RECTIFIER SYSTEM; I. A. Brackett, Wilkinsburg, Pa. App. filed Nov. 8, 1911. Vapor electric device having two anodes and a cathode.

1,036,796. SELECTIVE SIGNAL; L. W. Carroll, Anamosa, Ia. App. filed Oct. 1, 1906. Synchronizing vibratory device.

1,036,805. TELEPHONE; W. W. Dean, Elyria, Ohio. App. filed Aug. 9, 1909. Embedded U-shaped iron wires in a receiver or transmitter.

1,036,809. TELEPHONE APPARATUS; C. F. Dolle, Cincinnati, Ohio. App. filed Nov. 22, 1911. Desk stand with swinging receiver.

1,036,811. ARTICULATED LOCOMOTIVE; G. M. Eaton, Wilkinsburg, Pa. App. filed April 12, 1909. Friction-draft gear coupling arranged to oppose "nosing" between two half units.

1,036,815. ARC-LAMP ELECTRODE; G. Egly, Berlin, Germany. App. filed Sept. 28, 1909. Tungstate of a rare earth, tungstate of iron and a fluoride.

1,036,817. POLE CHANGER; C. J. Erickson, Chicago, Ill. App. filed Aug. 11, 1908. For telephone bell-ringer system.

1,036,818. LINE PROTECTIVE DEVICE; J. Erickson, Chicago, Ill. App. filed Nov. 22, 1911. Heat coil and line spring lock.

1,036,835. DYNAMO-ELECTRIC MACHINE; F. C. Hall, Wilkinsburg, Pa. App. filed Oct. 20, 1908. Direct-current generator with two commutators.

1,036,836. AUTOMOTONEER; G. W. Hamilton, Edgewood Park, Pa. App. filed Dec. 26, 1911. A drum with handle, ratchet and latch for delay action.

1,036,868. ELECTRIC SWITCH FOR SADIRONS; C. P. Madsen, Chicago, Ill. App. filed Jan. 22, 1908. Separable plug attachment with hand-regulating switch.

1,036,869. ALARM DEVICE; J. Marshak, New Haven, Conn. App. filed Aug. 19, 1911. Fire-bell alarm.

1,036,884. ARC LAMP; W. R. Mott, Lakewood, Ohio. App. filed July 29, 1911. Ventilation for a plurality of globes and arcs.

1,036,900. FREQUENCY METER; A. F. Poole, Wheeling, W. Va. App. filed Dec. 16, 1907. Clock-train escapement electromagnetically controlled.

1,036,901. ELECTRIC AND STEAM LOCOMOTIVE; J. F. Pope and H. V. Bennett, Morton Park, Ill. App. filed July 26, 1911. Interchangeable connection between the steam piston and the electric motor.

1,036,914. SYSTEM OF ELECTRIC-CURRENT DISTRIBUTION; H. M. Scheibe, Wilkinsburg, Pa. App. filed Oct. 8, 1910. Alternating-current-source secondary accumulators and an interposed vapor rectifier.

1,036,933. TRANSMITTER FOR THE DEAF; H. Tideman, Menominee, Mich. App. filed June 11, 1909. Differential, coaxial, conical, reflecting surfaces.

1,036,935. ELECTRICAL COIL AND METHOD OF MAKING THE SAME; C. R. Underhill, New Haven, Conn. App. filed Jan. 19, 1912. Alternating layers of wire and insulating tape with different pitches.

1,036,936. ELECTRICAL COIL AND METHOD OF MAKING THE SAME; C. R. Underhill, New Haven, Conn. App. filed Jan. 19, 1912. Alternating layers of wire and insulation with differential overlap.

1,036,937. METHOD OF MAKING ELECTRICAL COILS; C. R. Underhill, New Haven, Conn. App. filed Jan. 19, 1912. The interlying insulating tape is extended into concentrically wound heads.

1,036,951. ELECTRICAL DISTRIBUTION SYSTEM AND APPARATUS; V. G. Apple, Dayton, Ohio. App. filed Nov. 26, 1906. Rotary unidirectional switch for motor ignition, etc.

1,036,961. TELEPHONE-EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed March 17, 1905. Semi-automatic; the auxiliary switch and answering jacks and signals are combined.

1,036,990. ELECTRIC WATER HEATER; R. R. Foster, Colton, Cal. App. filed Oct. 14, 1911. Heater troughs are arranged in a cascade.

1,036,996. ELECTRIC INDUCTION FURNACE; A. E. Greene, Chicago, Ill. App. filed Feb. 12, 1912. Three-phase energy is transformed in the furnace to two-phase without unbalancing.

1,037,016. ELECTRIC-CIRCUIT CONTROLLER; H. Kaetker, Cincinnati, Ohio. App. filed Oct. 8, 1909. Rack and pinion contacts.

1,037,030. ELECTRIC HEATER FOR WATCHMAKERS; P. and F. Lux, Waterbury, Conn. App. filed April 8, 1912. Heating device for small work.

1,037,053. TELEPHONE-CALL REGISTER; C. V. Richey, Washington, D. C. App. filed April 17, 1911. Meter and lock-out.

1,037,059. ELECTRIC BELL; H. A. Schmidt, Chicago, Ill. App. filed Jan. 31, 1910. Double gong with special magnet and yoke connection.

1,037,061. PROCESS OF MANUFACTURING NITROGEN COMPOUNDS; A. Schweitzer and F. Hauff, Stuttgart, Germany. App. filed March 12, 1912. Carbon and an alkali fed through an electrically heated zone through which nitrogen is passed.

1,037,123. TROLLEY; F. Bury, Lyndora, Pa. App. filed March 14, 1912. Lateral retaining guides.

1,037,160. BATTERY VAULT; G. H. MacDonough, Chicago, Ill. App. filed March 16, 1912. Plurality of compartments, vented; railroad signal service.

1,037,172. IMPULSE TRANSMITTER; E. E. Clement, Washington, D. C. App. filed Aug. 23, 1906. Push-button signal switch for semi-automatic telephone.

1,037,181. CONTROLLER FOR ELECTRIC MOTORS; W. A. Paris, Edgewood Park, Pa. App. filed May 16, 1906. High-voltage switching device and automatic interrupter.